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SCIENCE

18 November 1955

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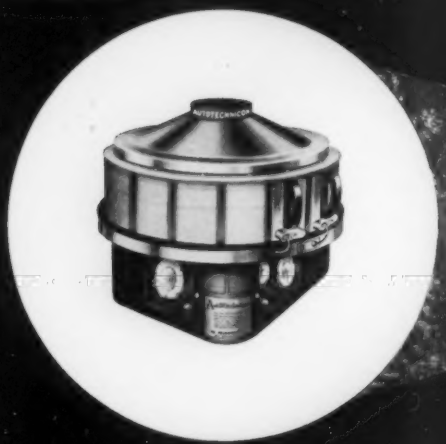

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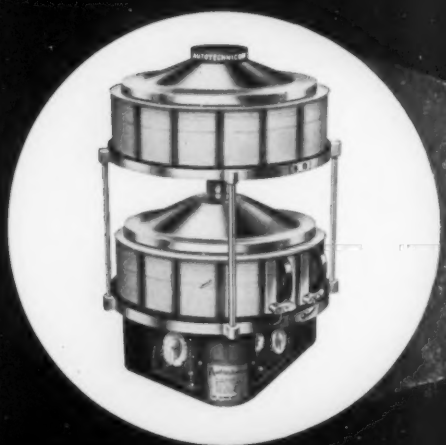

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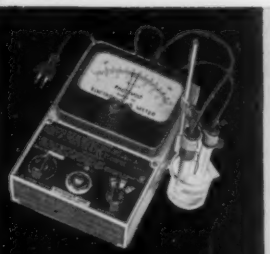

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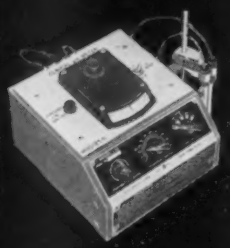

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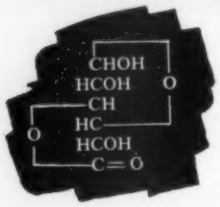

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SCIENCE, founded in 1880, is published each Friday by the American Association for the Advancement of Science at Business Press, Lancaster, Pa. Entered at the Lancaster, Pa., Post Office as second class matter under the Act of 3 March 1879.

SCIENCE is indexed in the *Reader's Guide to Periodical Literature* and in the *Industrial Arts Index*.

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Rushing into Print

There is a tendency these days among scientists to rush into print. More often now than ever before some scientists, having submitted a communication for publication, eventually ask to withdraw it or to be allowed to modify it because they either have discovered an error or have since learned that some of the work has been done elsewhere. This tendency is also revealed in the appalling state of corrected proofs received from some authors—sometimes peppered with corrections and changes which are, at the least, very expensive to make. Rushing into print is also inspired by the bugbear of priority. For example, the request by an author that his communication should be treated as urgent because he has learned that similar work is being done elsewhere is now treated like the cry of "Wolf! Wolf!" Requests of this sort are happening far too often. How refreshing it is when one team of workers, having heard that another is working along the same lines, gets in touch with the second group and arranges a joint communication.

There is much complaint today concerning the amount of scientific literature that each scientist must read if he is to keep pace with his own subject. There are many reasons for this overwhelming spate, not the least of which is the overenthusiasm of scientists themselves. Too many of them imagine that just because they have written a scientific paper it is worthy of publication. The result is that the whole field of our literature extends over a wide range of scientific merit.

Much of the detail published in a research paper is of limited interest and value. Men of science might well consider publishing only the main points of their research and filing the rest for possible reference. It was the late Lord Rutherford who once said that when writing a letter to *Nature* if you cannot say all that is really necessary in 500 words or less, then something is wrong. If every scientist throughout the world believed this and took it to heart, then I can visualize even *Nature* having no time-lag in publication at all. It is significant that, though *Nature* frequently returns a communication to an author with a request that it be reduced to two-thirds or one-half of its present length, I can recall only two or three instances in the whole of my more than a quarter of a century connection with *Nature* of an author replying that he could not cut his communication.

I rather imagine it would be a good idea if every communication submitted were returned without even being read by the editor, with a covering note asking: (i) Are you sure you have said what you want to say? (ii) Have you said it in the minimum number of words? (iii) It is worth saying at all? Too many scientists, especially younger ones, seem to assume that the value of a scientific paper varies directly as its length. I would strongly urge that men of science thoroughly train themselves to hold their lips tight and their pens dry until they know the facts or are sure of what they wish to say.—L. J. F. BRIMBLE, *Nature* (London).

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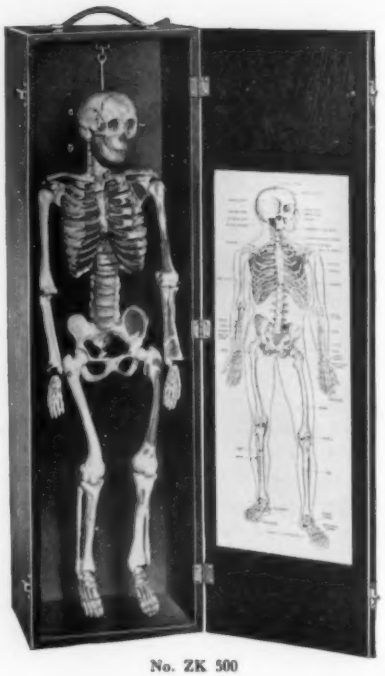

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18 November 1955, Volume 122, Number 3177 SCIENCE

Mach Rings Verified by Numerical Differentiation

Robert W. Burnham and J. Edward Jackson

The Mach ring effect is well known to certain psychologists and physicists and has been recorded as a part of the technical literature since 1865 (*1*). It is probably not so well known to others working in related fields. Mach established very definitively, using black-and-white patterned sector disks and rotating drums, as well as photographs of black-and-white line drawings, that the brightness of a perceived area is not simply a direct effect of the luminous intensity of local stimulation, but that it also depends on the distribution of stimulus luminances over a much larger area. Mach himself stated, "It is easy to go wrong in judging of the objective distribution of light according to the subjective impression." To illustrate the ubiquity of the effect, he summarized, "We came across the same phenomenon in the investigation of shadows, and of spectral absorption, and in countless other cases" (*2*, p. 219). The intent in this article is to report what is apparently an unusual source of the Mach ring effect and to suggest a well-known mathematical technique that can be applied generally to verify the effect with no limitation on the form of the stimulus luminance distribution.

Mach Rings in Electron Diffraction Patterns

This unusual source of the Mach ring effect is a modern technological one in which microdensitometric traces are made of the electron diffraction patterns of certain gas molecules. Typically, a film is exposed to the diffraction pattern, then processed. When the processed film is illuminated diffusely from behind, a characteristic series of concentric rings of varying widths and brightnesses may be seen; these are used to identify the particular gas molecule. The film is then placed in a microdensitometer and the varying luminous density across a diameter of the circular pattern is measured. In the present case, light and dark rings were seen on the illuminated film that did not bear a direct relationship to the luminance variations recorded on the densitometric trace.

The undulating curve in Fig. 1 is a smoothed drawing of the logarithm of the luminance (negative density) variations across a radius of the circular film pattern. The flat portion of the curve at the extreme left represents the limit of sensitivity in the microdensitometer. Higher portions of the curve represent areas of greater light transmittance through the film, and lower portions represent areas of lesser transmittance. The square-cornered curve superimposed on the luminance trace in Fig. 1 is a radial cross section representing the measured location and a roughly quantitative judgment of the relative brightness of the rings visible through the illuminated film. To correspond with the visual implications of the luminance curve, higher portions of this curve represent lighter rings and lower portions represent darker rings. If brightness bore a direct relationship to measured luminance, then large dips and rises like those in the brightness curve should have been found at corresponding positions in the log luminance curve. The fact that these large dips and rises did not appear was, indeed, puzzling until we were consulted for a possible explanation of the rings. A careful glance at the shape of the log luminance curve at positions (indicated by arrows) corresponding to the dips and rises in the brightness curve showed irregular acceleration in curvature. This immediately suggested the stimulus situation for the Mach ring effect.

The Stimulus for Mach Rings

Koffka (*3*, pp. 169–171) has described this situation in terms of the curves shown in Fig. 2. Where luminance varies uniformly from one side of an area to the other, as in curve *a* of Fig. 2, the stimulation at point *p* is the same as the average stimulation in its neighborhood, and a uniform brightness may be observed over the entire area. (The appearance of uniform brightness across an area having uniform variation in luminance is a well-established fact, not generally known, that dates back at least to Mach's report in 1865.) When, however, the luminance variation across the area is not uniform, as in curves *b* and *c* of Fig. 2, something else happens. The point *p* has a higher luminance in curve *b*, and a lower luminance in curve *c*, than the average of the points on both sides of *p* in the near vicinity. Under these conditions, and when the difference between the *p* luminance and that of the average of the neighboring points is large enough, the Mach effect appears. When the *p* luminance is greater than the average luminance of nearby points, a line will appear at *p* that is lighter than the neighboring areas; when the *p* luminance is less than the neighborhood average, a line will appear at *p* that is darker than the surrounding area. Typical Mach rings appear instead of lines when these luminance differences are found in concentric circular patterns.

Mach (*1*) has shown mathematically that the location and relative brightness of the rings can be predicted from the sign and magnitude of the second derivative of the luminance curve plotted as a function of distance across the area concerned. When the sign of the second derivative is positive, a dark ring appears, and when it is negative a light ring appears so long as the value of the second derivative is above some critical value.

The authors are on the staff of the Color Technology Division of Eastman Kodak Company.

Ludvigh (*4*, *5*) has recently refined this analysis to account for the edges, widths, and separation of the rings in terms of the second and fourth derivatives of the luminance function.

Application of Numerical Differentiation

In Mach's earlier studies, and in more recent studies by Thouless (*6*), Koffka and Harrower (*7*) and Ludvigh (*4*, *5*) energy distributions were used for which it was necessary to find substitute expressions for the second derivative because of infinite values at points of discontinuity. In the present case, although the luminance curve is continuous, the equation for the curve is not known. The second derivative may, however, be obtained directly from a tabulation of the ordinates of the luminance curve by the method of numerical differentiation. With certain simplifications, this solution can be easily worked out with a desk calculator. The solution consists first of choosing an appropriate interpolation formula, next taking derivatives of the formula, and finally applying the resultant formula for the second derivative to the function under consideration. Stirling's formula, (*8*, p. 70) was used for this purpose, but the results were later checked by Bessel's formula (*8*, p. 74) and found to be comparable. The second derivative of Stirling's interpolation formula for any value of the abscissa x is

$$\frac{d^2y}{dx^2} = \frac{1}{h^2}\left[\Delta^2 y_{-1} + u\left(\frac{\Delta^3 y_{-2} + \Delta^3 y_{-1}}{2}\right) + \left(\frac{12u^2 - 2}{4!}\right)\Delta^4 y_{-2} + \left(\frac{20u^3 - 30u}{5!}\right)\left(\frac{\Delta^5 y_{-3} + \Delta^5 y_{-2}}{2}\right) + \left(\frac{30u^4 - 60u^2 + 8}{6!}\right)\Delta^6 y_{-3} + \ldots\right]$$

Where

$$u = \frac{x - x_0}{h}$$

x_0 are the points on the abscissa where readings are taken, and h is the distance between readings (*8*, p. 129). If second derivatives of this function are required only at x_0, then $u = 0$, which simplifies the equation considerably. The equation may then be converted back into the original ordinates so that differences need not be used at all. A second simplification can result from converting the physical units of the abscissa into arbitrary units such that $h = 1$. The equation (using all terms through and including the sixth difference) then becomes

$$\frac{d^2y}{dx^2} = 0.011y_{-3} - 0.150y_{-2} + 1.501y_{-1} - 2.724y_0 + 1.501y_1 - 0.150y_2 + 0.011y_3.$$

This reduces the computing problem to one that can be readily solved on a desk computer. Although the results represent an approximation, they were adequate to verify the basic hypothesis; the technique may be useful to others who wish to extend the investigation of Mach rings to areas having irregular luminance variations.

Mach Rings and the Second Derivative

Results of the numerical differentiation are shown in Fig. 1, where the second derivative of log luminance has been obtained every 4 millimeters along the abscissa of the log luminance function, starting at the point that represents the limit of sensitivity of the microdensitometer. According to Ludvigh (*4*), the two edges of a ring appear symmetrically on each side of a second derivative maximum of appropriate magnitude. Ring locations have been designated by arrows in Fig. 1. Positive maxima may be predicted at the particular positions around which there is positive acceleration (as in curve *c* of Fig. 2) and negative maxima may be predicted at those positions around which there is negative acceleration (as in curve *b* of Fig. 2). Arrows pointing up indicate positions at which negative maxima would be predicted in the second derivative (lighter rings) and those pointing downward indicate positions at which positive maxima (darker rings) would be predicted. A comparison of the regions where the second derivative is most deviant from zero with the deviant regions of the related brightness curve gives a reasonable indication of the fact that the ring centroids are associated with the highest values of the second derivative.

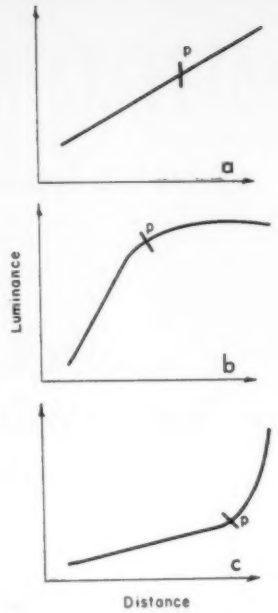

Fig. 2. Curve *a*, constant luminance gradient; curve *b*, negatively accelerated luminance gradient; curve *c*, positively accelerated luminance gradient.

What is not so clear by this approximation technique is the actual location of some of these rings. In tabulating data from a curve such as this, it is difficult to obtain data that are accurate to more than three significant digits. In so doing, small discontinuities are artificially introduced that show up as marked increases or decreases in the resultant derivatives. This is particularly true in the regions of the curve that show small changes in the first place. The oscillation of the second derivative represents, to some extent, the inherent variability of the method and can conceivably mask some of the differences being studied. To minimize this interference as much as possible, care should be taken in the tabulation of the data. The ordinates in this case were obtained by greatly expanding the scale on which the original data were plotted and then smoothing the resultant curve; the result was that the ordinates could be read off to three-digit accuracy. Additional distortion can result from too many or too few measurements per unit length of the abscissa.

Although these limitations exist in numerical differentiation, it does not appear

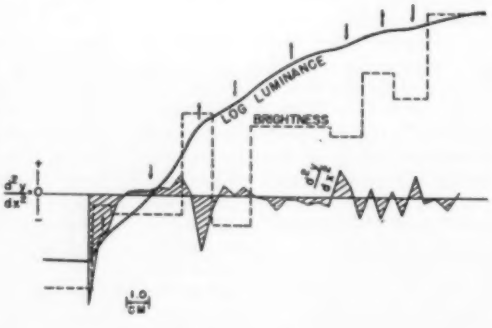

Fig. 1. Log luminance curve of radial cross section of electron diffraction pattern, brightness curve through same cross section showing relative brightness of Mach rings, and second derivative function of log luminance curve derived by numerical differentiation.

to be a great handicap in this example. Some of the rings are not clearly identified by sharp deviations in the second derivative, but usually the second derivative had a constant sign in the region of these rings except at the right end of the second derivative curve. Even there the preponderance of points was in the proper direction. It is conceivable that a closer association of rings with second derivative maxima could be found if the log luminance function had been transformed to visual units (such as Munsell value) before differentiating, since equal visual brightness units are not a direct logarithmic function of luminance over the entire range of visual brightnesses; a quintic parabola gives a closer fit. For our purposes, however, the association was close enough to verify the Mach hypothesis.

The surprising thing in this instance was the clear appearance of rings for what seem to be only minor undulations in the log luminance curve; reports in the literature have been concerned usually with somewhat larger gradient changes.

A possible, more general application of numerical differentiation to problems of this type is suggested because continuous second or higher derivative functions may be obtained from any irregular luminance distribution. Any conclusion regarding the complete validity of this application must depend, however, on a more systematic appraisal using refinements such as those recommended by Ludvigh (*4*) for computing the effective distribution of the proximal visual stimulus.

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Alfred F. Huettner, Scientist and Teacher

Alfred Francis Huettner, professor emeritus of biology at Queens College, died 27 September 1955 in his 73rd year at his home in Douglaston, Long Island, New York. He was born at Reichenbach, Germany, on 13 December 1882 and came to the United States in 1904. Neither in his youth nor later was he afraid of hard work in any form. He was largely self-supporting and worked at a variety of jobs, including working as a section hand and shipping on as a sailor. It may well be that his early hardships fostered the keen sympathy and interest he showed later for his students, many of whom had to work for their own support.

He was delayed in his college work and graduated with a B.A. degree in 1916 from the University of South Dakota. In the fall of 1916, he entered Columbia University to do his graduate work in zoology under E. B. Wilson; the degree of doctor of philosophy was conferred on him in 1923. His dissertation, "The origin of the germ cells in *Drosophila melanogaster*," was a significant cytological work of technical difficulty and proved the multiple origin of the germinal nuclei in the fruit fly. This explained unexpected genetic findings in somatic mutation. Previously it had been supposed that the isolation of the germ cells in *Drosophila* was similar to that found in earlier work on *Miastor* and on *Chironomus*.

Dr. Huettner continued teaching and research on the staff of Columbia University as instructor and assistant professor until 1932, when he joined the biology department at Washington Square College of New York University as associate professor. He was promoted to professor in 1936. He joined the biology department of Queens College, Flushing, New York, in 1938, the second year of the college. There he organized the instruction in vertebrate zoology and vertebrate embryology. He retired in 1952 after serving for 7 years as chairman of the department. During all his years of active duty at Queens College, he also carried the burden of the premedical and predental committee chairmanship. He did not spare himself in this work, nor in any other, and rendered great service to the college and its students. It was quite fitting that on his retirement the Board of Higher Education honored him by naming him the first professor emeritus of Queens College.

Following his first cytological work already referred to, Dr. Huettner continued with cytological studies on the chromosomes and on the central bodies of the fruit fly. Possibly of more significance was his work on the early embryological stages of *Drosophila* that was carried out with the active collaboration of students. Benjamin Sonnenblick completed one phase of this project, which was published as a chapter in *Biology of Drosophila*. Dr. Huettner's last major contribution to science and teaching was achieved with the publication of his book, *Fundamentals of Comparative Embryology of the Vertebrates*. This book is still very widely used and is unique in the excellence of its three-dimensional illustrations, most of which were his own drawings based on his own preparations. Much original research went into the preparation of this book.

The admirable reputation of Dr. Huettner as a teacher was based on his wide knowledge of the biological sciences and his enthusiasm for the subject, which he was unusually successful in imparting to his students. His personal interest in students won him their esteem and affection. He interrupted his labors to give his time and help to colleagues and friends as well as to students. He was a man who set high standards of moral and intellectual integrity for himself and was able to live up to them.

Dr. Huettner enjoyed working at his home and in his garden; he became proficient in the laying of concrete walks and walls. He enjoyed the distinction of having grafted seven kinds of fruit on one tree and lilacs on his privet hedge. He was a man of many talents.

Dr. Huettner was a member of Sigma Xi and several scientific societies.

DONALD E. LANCEFIELD

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Yale Natural Radiocarbon Measurements II

Richard S. Preston, Elaine Person, E. S. Deevey

In the first paper of the Yale University series of radiocarbon measurements (*1*), and in an article published separately (*2*), we reported measurements of natural carbon-14 made by Libby's solid-carbon counting method. Acceptable assays were possible only during periods when nuclear weapons were not being tested in Nevada or in the Pacific, mainly during each July to February period. In August 1954, however, some anthracite blanks were found to be contaminated, presumably as a result of Soviet activity, and this unhappy experience led us to abandon the solid-carbon method. Most of the data reported in this article (*3*), which include all satisfactory figures obtained since February 1954, have been taken by the acetylene method of Suess (*4*). Among several important advantages, Suess' method has the outstanding attraction that the carbon to be measured is never exposed to airborne contamination; a sample is converted to acetylene, and during its purification and subsequent manipulation the glass walls of the vacuum system shield it from external influences.

We have made few important changes in the counting system designed by Suess. Each of our two counters has an inside diameter of 7 centimeters and contains 2.5 liters of acetylene. The counters are filled to a pressure of 68 centimeters (mercury); they give a higher net counting rate (and also a higher background) than Suess' 1-liter counters. The counters are shielded by 20 centimeters of iron, and one of them, counter 1, is surrounded by an additional 1.25 centimeters of iron inside the ring of anticoincidence counters. The additional iron was intended to be a partial substitute for a mercury mantle. A calculation based on Suess' background counting rate and on the dimensions of Suess' counters and ours indicates that with a mercury mantle we should have a background counting rate of about 6 counts per minute. We find that the counter without additional shielding has a background rate of about 9.7 counts per minute, while the counter with the extra shielding has a background rate of about 8.2 counts per minute.

We have installed a system for monitoring counting rates during runs, which typically are 24 hours long. Pulses from four channels are monitored. Two of these channels are the ones that transmit all of the pulses from each of the proportional counters; the other two channels transmit only those pulses from the proportional counters that are in anticoincidence with pulses from their surrounding rings of Geiger counters. After passing through scaling circuits, the pulses from the different channels are fed to different keys on a 13-column adding machine, and totals are printed on tape at preset intervals such as 1 hour. By using this device, we maintain constant check on instrumental aberrations of various sorts.

Calibration assays are given in Table 1.

Modern carbon (a sample of hemlock, tree-ring dated as A.D. 1840–1850, from Norfolk, Conn.) gave a mean counting rate of 28.36 counts per minute in counter 1, and 29.11 counts per minute in counter 2. Anthracite samples averaged 8.25 counts per minute in counter 1 and 9.74 counts per minute in counter 2 for the whole period under consideration. Review of all the components of these averages shows that our background is not quite so stable as that of the Washington laboratory—fluctuations above or below the means are greater than 2 σ (as calculated from $\sqrt{\text{number of counts/time}}$) more often than chance alone would dictate. Recently we identified and corrected a defect in the electrostatic shielding associated with counter 2 so that the background in this counter has been reduced. However, it may be more than a coincidence that the largest fluctuations occurred during the most intense period of nuclear weapons testing in the spring of 1955.

Since the duplicate measurements of the same samples, other than those of modern wood and anthracite, have always agreed within statistical expectation, we have accepted all values obtained for unknown samples, but have been more conservative than usual in stating their standard errors. Moreover, because there is evidence of a downward trend in the background count over the whole period from December to June, we have divided the series into two parts and have calibrated and calculated dates separately for each. This accounts for the differences given below in the ages of "infinitely old" samples (based on background + 2 σ), and it also accounts for the variations among the standard errors (based on $\pm$ σ) in some cases where the ages are approximately the same.

A few samples have been measured at half the standard pressure because of the lack of sufficient material for a full-pressure run; these have exceptionally large standard errors because there have been few calibration runs at half pressure.

Our conservative procedure in calcu-

Table 1. Calibration assays, counts per minute. All dates are 1955.

Date	Counter 1	Date	Counter 2
*Anthracite: four separate preparations**			
25 Jan.	8.74	4 Mar.	9.89
24 Feb.	7.99	10 Mar.	10.03
25 Feb.	8.24	13 Mar.	10.06
26 Feb.	8.50	15 Mar.	10.36
1 Mar.	8.32	16 Mar.	10.21
5 Mar.	8.29	23 Mar.	9.91
13 Mar.	8.54	24 Mar.	9.81
4 Apr.	8.24	1 Apr.	9.69
6 Apr.	8.39	3 Apr.	9.61
7 Apr.	8.11	11 Apr.	9.53
8 Apr.	8.23	12 Apr.	9.47
10 Apr.	7.94	22 Apr.	9.64
15 Apr.	8.15	16 May	9.29
3 May	8.31	9 June	9.20
27 May	8.05	10 June	9.40
28 May	8.01		
Mean, Jan.–Apr.	8.28	Mean, Mar.–Apr.	9.85
Mean, May–June	8.12	Mean, May–June	9.30
σ, Jan.–Apr.	0.222	σ, Mar.–Apr.	0.277
σ, May–June	0.163	σ, May–June	0.100
σ_s, Jan.–Apr.	0.062	σ_s, Mar.–Apr.	0.080
σ_s, May–June	0.094	σ_s, May–June	0.058
Modern wood: two separate preparations†			
31 Jan.	28.15	28 Mar.	29.25
5 Feb.	28.49	13 Apr.	29.11
16 Feb.	28.15	3 May	29.13
31 Mar.	28.63	26 May	28.94
Mean	28.36	Mean	29.11
σ	0.244	σ	0.128
σ_M	0.122	σ_M	0.064
Standard error of a single run (σ_s)			
Jan.–Apr.	0.219	Jan.–Apr.	0.244
May–June	0.196	May–June	0.107

* $\sqrt{\text{No. of counts/time}}$ ranges from 0.05 to 0.1 for individual runs on anthracite samples.

† $\sqrt{\text{No. of counts/time}}$ ranges from 0.8 to 0.14 for individual runs on modern wood samples.

Dr. Deevey is director of the Geochronometric Laboratory, at Yale University. Dr. Preston and Mrs. Person are former members of the staff.

lating standard errors is to ignore the standard error derived from the statistics of a single run ($\sigma = \sqrt{\text{number of counts}}/\text{time}$), and to regard each run of 24 hours or longer as an independent variate, with variations over a period of weeks assumed to be Gaussian. An unknown sample is assigned a standard error σ_S representing the standard deviation from the mean values of all background and all modern wood counts obtained during the appropriate period. Standard deviations of the background σ_B and of modern wood σ_M also enter into the calculations; they are the standard errors of the appropriate means,

$$\sigma/\sqrt{n},$$

where n is the number of independent measurements.

The final calculation of the standard error is by the formula

$$\sigma = \frac{\sqrt{(S-B)^2\sigma_M^2 + (M-S)^2\sigma_B^2 + (M-B)^2\sigma_S^2}}{(S-B)^2},$$

where σ is the standard error of the ratio

$$\frac{M-B}{S-B},$$

and S, M, and B are the sample counting rate, the mean modern counting rate and the mean background counting rate, respectively, and σ_S, σ_M and σ_B are their standard errors as defined in the previous paragraph. This formula for σ results from the rule that when $X, Y, \ldots$ are average values of measured quantities with standard errors of $\sigma_X, \sigma_Y, \ldots$, respectively, then a function

$$Z = f(X, Y, \ldots)$$

has a standard error given by

$$\sigma_Z = \sqrt{\left(\sigma_X \frac{\partial Z}{\partial X}\right)^2 + \left(\sigma_Y \frac{\partial Z}{\partial Y}\right)^2 + \ldots}$$

In terms of the statistical procedure suggested by the Copenhagen conference (*5*), we include ϵ_s and ϵ_r, the errors of the sample and of the reference standard, but combine them in a more accurate way; we do not include ϵ_f, the error introduced by the fractionation of isotopes in the synthesis of acetylene, or ϵ_h, the error of the half-life determination; our calculations assume a half-life of 5568 years.

The dates reported in Table 2 are mainly related to three projects, each of which is to be more fully discussed in papers now in preparation by collaborators. The longest series is entitled "North American Geology"; the principal collaborator is R. F. Flint. Partly related to this project is a series covering the Alaskan Little Ice Age that is being conducted in collaboration with D. B. Lawrence and K. B. Bengtson. The third series bears on Caribbean archaeology; Irving Rouse is mainly responsible. The miscellaneous samples are less directly related to these chief projects; dates from Iceland and Greenland are relevant to some from arctic America that are included under North American geology, while the samples from the Pacific and from the Southern Hemisphere were considered of interest in connection with results from Pyramid Valley, New Zealand, that were reported in the first paper of the Yale series (*1*). Three projects now under investigation will be reported later: Paleolithic and Neolithic of northwestern Europe, Southern Hemisphere, and a study of modern assay.

When two dates are given without brackets in Table 2, they represent independent preparations of fresh portions of the original sample; duplicate 24-hour measurements of the same gas have been combined into a single date according to the usual practice, unless they were measured at widely separate times or in different counters, in which case the less reliable dates are enclosed in parentheses. Dates enclosed in square brackets were obtained by Libby's solid-carbon counting method.

Table 2. Radiocarbon dates

Sample No.	Description	Age (years)
I. *Alaskan Little Ice Age and related samples*		
Y-4	*Bengtson 27.* Hemlock stump in upright position, sheared by ice and buried in 30 to 40 feet of outwash, overlain by 25 to 30 feet of till, exposed in valley of Fossil Tree Creek, about ½ mile from tidewater at 300-foot altitude, on south side of Geikie Inlet of Glacier Bay. Collected in 1950 and submitted by K. B. Bengtson.	1540 ± 130
Y-5	*Bengtson 49.* Fragment of gnarled alpine timber, not rooted in place but probably of local origin, on terrain thinly mantled by till at 2700-foot altitude on south side of a nunatak on north part of Brady Glacier, near present firn line but below former maximum height of firn. Collected in 1950 and submitted by K. B. Bengtson.	Modern [Modern]
Y-6	*Bengtson 54.* Stump, rooted in place, sheared by ice and buried under 5 to 10 feet of till at 1200-foot altitude, 75 feet above present ice surface of Geikie Glacier near Hugh Miller Col. Moraine evidence indicates ice surface was 700 feet above this point at the latest maximum. Collected in 1950 and submitted by K. B. Bengtson.	1520 ± 140 [430 ± 170]
Y-7	*Bengtson 55.* Stump, apparently rooted in place, sheared by ice and buried in till at 650-foot altitude ¾ mile from tidewater, exposed in a stream valley on the north side of Geikie Inlet. Collected in 1950 and submitted by K. B. Bengtson.	760 ± 130 (950 ± 110)
Y-8	*Bengtson 56.* Stump, rooted in place, and probably sheared by ice after burial by water-laid sands and clays, below present high tide line on west shore of Glacier Bay opposite Willoughby Island. Collected in 1950 and submitted by K. B. Bengtson.	4040 ± 150
Y-9	*Bengtson 60.* Fragments, mostly from small deciduous trees, in very compact till 50 to 60 feet below till surface on east side of terminus of Reid Glacier (the northeastern tidewater distributary of Brady Glacier). Collected in 1950 and submitted by K. B. Bengtson.	4680 ± 160 [4600 ± 105]
Y-10	*Bengtson 62.* Stump, apparently rooted in place, sheared by ice and buried in 60 feet of sand, silt, and clay at 50-foot altitude about ¾ mile north of the entrance to Geikie Inlet on the west side of Glacier Bay. Collected in 1950 and submitted by K. B. Bengtson.	7050 ± 240
Y-32	*Bengtson 43–45.* Remains of gnarled alpine timber, rooted in place and imbedded in till, below the upper limit of till deposition at end of a spur projecting into the east side of the south part of Brady Glacier at 1600-foot altitude. Collected in 1950 and submitted by K. B. Bengtson.	Modern [Modern]
Y-37	*Bengtson 47.* Stump of alpine timber, crushed by ice, 6 miles south along Brady Glacier from location of sample Y-32, but in the same stratigraphic position. Collected in 1950 and submitted by K. B. Bengtson.	Modern

Sample No.	Description	Age (years)
Y-132-80	*Lawrence F50-9.* Transported log, found on recently deglaciated terrain 60 feet west of (outside) edge of Mendenhall Glacier about 5 miles north of Juneau airport. Collected in 1950 and submitted by D. B. Lawrence; Lawrence's station 17. *Comment*: a similar sample was dated by the Lamont laboratory (L-106C) as 1790 ± 285 years (*6*, p. 568).	2790 ± 130 [3010 ± 140]
Y-132-84	*Lawrence F50-8.* Stump, rooted in place, exposed in a gravel pit on north side of valley of Mendenhall Glacier on terrain deglaciated before A.D. 1910 but inside the belt of first-generation forest. Collected in 1950 and submitted by D. B. Lawrence; Lawrence's station 15. *Comment*: compare with samples Y-132-80 and L-106C.	1090 ± 60 [630 ± 130]
Y-132-81	*Lawrence F50-1.* Stump, rooted in place, on terrain deglaciated between A.D. 1931 and 1941, south of Wolf Point at head of Muir Inlet, Glacier Bay. Collected in 1950 and submitted by D. B. Lawrence.	7000 ± 210 [7160 ± 240]
Y-132-82	*Lawrence F50-2.* Stump, rooted in place, similar to sample Y-132-81, but found on terrain deglaciated between A.D. 1911 and 1931, Anchorage Cove, Muir Inlet, Glacier Bay. Collected in 1950 and submitted by D. B. Lawrence.	6300 ± 200 [6930 ± 270]
Y-132-85	*Lawrence F50-3.* Stump, rooted in place, similar to samples Y-132-81 and Y-132-82, but found on terrain deglaciated between A.D. 1903 and 1911, Forest Creek, Muir Inlet, Glacier Bay. Collected in 1950 by Paul Livingston and submitted by D. B. Lawrence.	1860 ± 120 1910 ± 120
Y-132-83	*Lawrence F50-5.* Stump, rooted in place at mid-tide on south shore of Bartlett Cove, Glacier Bay, on terrain deglaciated since the 18th century. Cooper station 55; collected in 1950 and submitted by D. B. Lawrence.	190 ± 50 [Modern]
Y-132-86	*Lawrence F50-4.* Another stump found in the same locality as Y-132-83.	Modern [Modern]
Y-132-100	*Ameghino Glacier, Argentina.* Stump, rooted in place in an old soil and buried in nonweathered outwash, exposed by erosion, in front of Ameghino Glacier west of Lago Argentino, Patagonia. The stump is one of those figured in Fig. 12 of Nichols and Miller (*7*). Collected in 1949 by Maynard Miller and submitted by D. B. Lawrence; Miller's sample B-2.	Modern
Y-133	*Hanker Creek, Yukon: wood.* Poplar stump, rooted in place in the second-lowest of four organic horizons exposed by mining in the northeast wall of Hanker Creek, Klondike region, central Yukon Territory. The three lowest organic horizons are cut by a fossil ice vein that is truncated at the uppermost organic horizon. Thus the tree antedated a period of freezing that was followed by one of thawing. Collected in 1951 and submitted by John D. Campbell; Campbell's sample FF 6_2.	[8900 ± 320]
Y-134	*Hanker Creek, Yukon: peat.* Nonhumified sphagnum peat from the bottom of a bed 17 feet thick, lacking stratification and without ice veins, overlying coarse gravel on the opposite (southwest) side of Hanker Creek from position of Y-133. Apparently the peat is still forming; clearly it postdates a period of thawing when the valley was aggraded. Collected in 1951 and submitted by John D. Campbell; Campbell's sample CC16.	[6130 ± 200]
Y-140	*Mount Garibaldi, British Columbia.* Yellow-cedar wood, rooted in place, from an old forest on a barren nunatak, covered until about A.D. 1940 by the glacier on the east side of Mount Garibaldi, southwestern British Columbia. Described by Mathews (*8*); collected and submitted by W. H. Mathews.	5850 ± 180
Y-211	*Coleman Glacier, Wash.* Fir wood from moraine of Coleman Glacier, Mount Baker, about 15 feet below top of medial moraine, probably formed at the maximum advance of A.D. 1750. Collected and submitted by A. E. Harrison.	[250 ± 250]
II. *North American Geology*		
	A. *Eastern Sector*	
Y-123	*North Bay, Ontario.* Layer of peat with wood fragments, containing 62 percent birch, 27 percent pine, and 10 percent hemlock pollen, suggesting early postglacial time (zone C-1?), covered by 3 to 4 feet of coarse till-like material, believed to be till reworked by Lake Algonquin, exposed at east end of North Bay airport, 5 miles northeast of North Bay; altitude 1204 feet. Collected in 1951 and submitted by A. Dreimanis. *Collector's comment*: the peat lies close to the present surface and was evidently contaminated by tree roots.	[400 ± 200] [400 ± 200]
Y-164	*St. Narcisse, Quebec.* Wood, buried beneath 8.5 feet of sediment, originally believed to be outwash from Saint Narcisse moraine and overlying thick marine clay, Becancour map area (National Topographic Series, sheet 31 I/8), north branch of Champlain River below hydroelectric power line, 1000 feet downstream from wooden bridge on town road, near Vincennes. Collected in 1952 and submitted by N. R. Gadd; Gadd's wood sample No. 2.	[3260 ± 210]
Y-215	*Champlain Sea: Hull, Quebec.* Shells, *Saxicava and Macoma,* from Champlain Sea deposit about 30 feet below former surface of gravel pit on Mountain Road, 6 miles west northwest of Hull, National Topographic Series sheet 31 G/5, altitude 392 ± 4 feet. Collected in 1953 and submitted by J. A. Elson.	10,630 ± 330 [11,050 ± 400]
Y-216	*Champlain Sea: Uplands, Ontario.* Shells of *Macoma* with some *Balanus* and *Saxicava* from Champlain Sea deposit in an old pit or gully at northwest corner of Uplands airport, about 5 miles south of center of Ottawa; altitude 323 ± 2 feet. The section has been fully described by Johnston (*9*). Collected in 1953 and submitted by J. A. Elson.	10,850 ± 330 [8900 ± 320]
Y-233	*Champlain Sea: Notre Dame des Neiges, Quebec.* Shells, *Macoma* and *Saxicava,* from 3 feet or less below surface of Champlain Sea deposit, Notre Dame des Neiges cemetery, Mount Royal; surface altitude 545 feet. Collected by F. J. E. Wagner and submitted by V. K. Prest. *Comment*: the three dates (samples Y-215, Y-216, and Y-233) for Champlain Sea deposits are all based on shells, which probably con-	11,370 ± 360

Sample No.	Description	Age (years)
	tained some proportion of old carbon derived from limestone in the drainage basin.	
Y-242	*St. Pierre-Les-Becquets, Quebec.* Wood underlying varved silt, which is overlain elsewhere by gray till, St. Pierre-les-Becquets. Collected and submitted by N. R. Gadd. *Comment*: this sample serves as an interlaboratory check; it was dated (sample W-189) as more than 40,000 years by the U.S. Geological Survey's Washington laboratory (*10*, p. 485).	> 30,840 > 29,630
Y-254	*Les Vieilles Forges, Quebec: wood.* Wood from below 204 feet of stratified deposits including till and laminated silt, in measured section near Les Vieilles Forges on west bank of St. Maurice River ¼ mile downstream from an unnamed stream that crosses the highway near Les Vieilles Forges village. Collected in 1954 and submitted by N. R. Gadd. *Comment*: this bed of peat and wood is believed to be correlative with that at St. Pierre-les-Becquets from which Y-242 was collected.	> 29,630
Y-255	*Les Vieilles Forges, Quebec: peat.* Peat from the same layer as the wood, sample Y-254. Collected and submitted by N. R. Gadd.	> 30,840
Y-256	*Pierreville, Quebec.* Compressed peat with some wood from below 38.5 feet of thin-bedded silt and sand overlying a thick measured section, including varved sediments that are believed to be correlative with the varved material overlying samples Y-242 and Y-255. The section is at Pierreville in a ravine on the east bank of the St. Francis River 1.7 miles upstream from bridge on Highway No. 3 (Yamaska map sheet, 31 I/2). Collected in 1954 and submitted by N. R. Gadd.	> 29,630
Y-251	*Hartford, Conn.* Log, exposed in a sewer excavation, in alluvium that seems to be graded to a Connecticut River terrace at 30- to 40-foot altitude, overlying varved clay and silt, in Hartford North quadrangle, about 200 feet west of New York, New Haven and Hartford Railroad tracks and 2000 feet north of the junction of a tributary with the North Branch of the Park River. Collected after the excavation had been made in 1954 and submitted by R. E. Deane.	10,650 ± 320
Y-253	*New Britain Channel, Conn.* Wood from cross-bedded gravel member exposed in the northeast face of Stiles-Reynolds Brick Company pit, south of South St., New Britain, in mouth of New Britain Channel. Wood is in transported fragments, deposited contemporaneously with pebbles in the gravel; the gravel should date the discharge from the lake in which the Hartford "varved clay" accumulated. Collected in 1954 by Kurt Servos, Estella Leopold, and R. F. Flint.	10,710 ± 330
Y-282	*Durham, Conn.* Gyttja from upper part of the Durham spruce-pollen zone, Durham Meadows, Durham, 2.35 to 2.55 meters in Boring Dur-C. Collected in 1953 and submitted by Estella B. Leopold. *Comment*: this sample and Y-285 are discussed by Leopold in an unpublished Ph.D. dissertation and in a paper now in preparation.	8155 ± 410
Y-285	*Totoket, Conn.* Gyttja from lower part of the Durham spruce-pollen zone, Totoket Bog, North Branford, 2.75 to 3 meters at base of gyttja, immediately above second high-nonarboreal-pollen zone. Collected in 1954 and submitted by Estella B. Leopold.	13,550 ± 460
	B. *Central Sector*	
Y-155	*Dufresnoy, Ontario.* Wood, under 3 feet of a till-like deposit and overlying varved clay and silt, Dufresnoy Township, 1 mile south of Destor; altitude about 1100 feet. If the overlying material is till, the sample should antedate the "Cochrane" glaciation. Collected by A. S. MacLaren and submitted by J. A. Elson and Heikki Ignatius. *Comment*: the overlying material is evidently not till, as was suspected by several students of the Cochrane problem. Compare samples W-176, 5300 ± 300 years (*10*, p. 485); W-136, 6380 ± 350 years (*10*, p. 485); and Y-222, for post-Cochrane dates.	[Modern]
Y-165	*Rossendale, Manitoba: peat.* Peat, buried under 13 feet of alluvium associated with Lake Agassiz II, from reservoir in gully in SW¼ sec.25, T9, R2., W. Prin, Manitoba, 3 miles south and 1 mile east of Rossendale; altitude 1052 ± 5 feet. Collected in 1952 and submitted by J. A. Elson; Elson's No. F52-22.	12,400 ± 420 [13,230 ± 600]
Y-166	*Rossendale, Manitoba: shells.* Freshwater clam shells from same alluvium as Y-165, Assiniboine estuary, SW¼ sec.13, T9, R9, W. Prin, Manitoba, 6 miles south and 2.25 miles east of Rossendale, 15 feet below terrace. Collected in 1952 and submitted by J. A. Elson; Elson's No. F52-24. *Comment*: the dates for samples Y-165 and Y-166 are considered to represent the age of a delta built into Lake Agassiz.	[11,230 ± 480]
Y-11 Y-13 Y-64 Y-65	*Cypress River, Manitoba.* Wood, charcoal, and peat from alluvium of Cypress River, a tributary of the Assiniboine River, supposedly graded to delta of Lake Agassiz, lat. 49°30'N, long. 99°04'W, NW 8-6-12, W. Prin, Manitoba. Collected in 1950 and 1951 and submitted by J. A. Elson. *Comment*: these samples were repeatedly measured by the solid-carbon method; the oldest date found was that for the charcoal sample Y-64, 2560 ± 200 years. Both peat samples, Y-13 and Y-65, consistently dated "modern." The acetylene date for Y-11, which was wood, is accepted, and the solid-carbon dates are rejected as possibly or probably contaminated.	2830 ± 130
Y-222	*Dugwal, Ontario.* Peat from a bog near Dugwal from shell-rich layer 10 to 15 centimeters thick, overlain by 3.3 meters of peat and underlain by gray homogeneous clay. Pollen analysis of the section is in preparation. Collected in 1952 by Heikki Ignatius and J. A. Elson. *Comment*: the bog overlies till laid down by the latest glaciation in the Cochrane district; compare dates for samples W-176 and W-136, which are cited under Y-155.	6730 ± 200 [6970 ± 310]

Sample No.	Description	Age (years)
Y-250	*Hibbing, Minn.* Spruce or tamarack wood from a log buried under 50 feet of Pleistocene till, overlying outwash, on east face of Douglas Mine in the Mesabi Iron Range near Hibbing. Collected in 1954 and submitted by Richard L. Pierce.	> 36,490
Y-227	*Two Creeks, Wis.* Spruce wood from the type locality of the Two Creeks forest bed, Manitowoc County. Collected and submitted by F. T. Thwaites. *Comment*: this sample serves as an interlaboratory check; compare with the mean of five Chicago dates (samples C-308, C-365, C-366, C-536, and C-537), 11,404 ± 350 years (*11*, p. 117), and the mean of two Washington dates (samples W-42 and W-83), 11,370 ± 100 years (*12*, p. 471).	11,130 ± 350
Y-147X	*Green Bay, Wis.* Log, not growing *in situ* but transported by the ice that deposited gray (Mankato) till, exposed in a borrow pit in SW¼SW¼ sec. 23, T24N, R21E, Green Bay, Wis. Sand underlies the till and probably conceals the original position of the forest bed from which the trees were derived; the wood should be of Two Creeks age, transported by Mankato ice. Collected in 1952 and submitted by F. T. Thwaites.	[11,940 ± 390]
Y-237	*Menasha, Wis.* Log, supposedly crushed by ice, inclosed in red clay in a sewer trench, 15 to 16 feet deep, on Prospect St., Menasha, in NE¼SW¼ sec. 15, T20N, R17E, about 150 feet east of Little Lake Butte des Morts and 2 miles south of the locality of sample C-419 (*11*, p. 118). Collected in 1952 by the excavator for McMahon Engineering Company and submitted by F. T. Thwaites. *Comment*: this sample was expected to be of Two Creeks age.	11,690 ± 370
Y-238	*Marinette, Wis.* White oak wood from a sewer trench in Marinette collected before 1943 and stored at the Wisconsin Geological and Natural History Survey; submitted by F. T. Thwaites. *Comment*: from the altitude, 600 feet or less, and from the relationships of Algonquin and Nipissing shorelines in this district, Thwaites expected the sample to date from either the maximum or the recession of Lake Nipissing.	4880 ± 190
Y-293B	*South Haven, Mich.: Bowmanville wood.* Wood from top of basal blue silt at site described by Zumberge and Potzger (*13*), exposed by wave action on shore of Lake Michigan at South Haven. Submitted by James H. Zumberge. *Comment*: this sample has been dated by the Michigan laboratory (sample M-288a) 11,200 ± 600 years (*13*, p. 310). It dates the Bowmanville low-water phase in the Lake Michigan basin.	10,550 ± 150
Y-293A	*South Haven, Mich.: peat.* Sandy peat or gyttja from the lowest 2 inches of the 30-inch layer at South Haven. The organic material overlies the silt in which Y-293B was found and is buried by a 25-foot sand dune. Submitted by James H. Zumberge. *Comment*: this sample has been dated by the Michigan laboratory (sample M-288) 7925 ± 400 years (*13*, p. 310) and by the Chicago laboratory (sample C-846) 6744 ± 530 years (*14*, p. 735). It dates the waning of the spruce-fir pollen time at this locality. Whether it also dates the time when the level of Lake Algonquin had begun to fall is less certain, and depends on the depth of water in which the organic matter was deposited.	9500 ± 250
Y-169B Y-169	*South Haven, Mich.: wood.* White pine wood from the central part of the 30-inch organic layer at South Haven. Submitted by James H. Zumberge. *Comment*: the solid-carbon measurement was believed to be affected by contamination, and a new sample (Y-169B, the same as M-290A) was submitted after collection by J. E. Potzger. The wood has been dated by the Michigan laboratory (M-290) 5090 ± 300 years (*13*, p. 310) and by the Chicago laboratory (C-848) 6440 ± 230 years (*14*, p. 735). Pollen at this level in the organic layer belongs to an oak-pine period.	5660 ± 100 [5300 ± 250]
	C. *Western Sector*	
Y-109	*Paisley Cave, Ore.* Rodent droppings from Paisley Cave No. 3, immediately under the pumice layer from the Mount Mazama eruption that formed Crater Lake. Collected in 1951 and submitted by L. S. Cressman. *Comment*: the Chicago laboratory (*11*, p. 117) obtained a mean date of 6450 ±250 years for charcoal from a tree killed by this eruption (sample C-247). Doubts have been expressed about the Chicago date in view of the possibility of postdepositional exchange of carbon from ground water. Paisley Cave is dry and the sample is free from this objection; the acetylene date is significantly older by a small margin but probably does not change the geologic picture (*15*).	7610 ± 120
Y-267 Y-281	*Searles Lake, Calif.* Two samples of carbon purified and assayed by the Chicago laboratory from borings beneath the floor of Searles Lake.	
	Y-267: carbon residue of sample C-897, which was dated 23,920 ± 1800 years (*14*, p. 739); this sample came from the bottom 1 foot of the "mud" layer between the upper and lower salt bodies, 82.8 to 83.8 feet. The agreement is regarded as satisfactory, for the acetylene sample was run at half the standard pressure.	21,200 ± 2170
	Y-281: carbon residue from sample C-616, which was dated as more than 19,000 years (*16*, p. 138). This sample came from just below the lower salt body in another location where a sample (C-615) of the lowest 2 feet of the "mud" layer was dated as more than 16,000 years (*17*, p. 294). The acetylene sample has been measured twice, with essentially perfect agreement, but in periods a month apart when the backgrounds may have been different. Because the age of the material is uncomfortably close to the limits of acetylene counting, and because the prolonged chemical treatment these samples have received has undoubtedly given opportunity for isotopic fractionation, new samples must be obtained before the age of the lower salt body can be considered as fixed.	25,890 ± 1120 (> 29,630)

Sample No.	Description	Age (years)
	D. *Arctic America*	
Y-231	*Rankin Inlet, District of Keewatin.* Peat, rich in fungus spores, from a 6-inch layer covered by 3 to 4 feet of till, Rankin Inlet, Northwest Territories, lat. 62°50′N, long. 92°12′W. Collected in 1953 and submitted by Z. L. Sujkowski.	5220 ± 340
Y-261	*Back River, District of Keewatin.* Peat, from a layer 1 to 1½ inches thick between two silt layers, overlain by 8 feet of sediment including lacustrine silt and outwash, laid down in front of the last ice lobe known in the district; the overlying silt is divided into two parts by a zone of involutions. Exposed in the middle Back River region, Northwest Territories, lat. 66°10′N, long. 97°03′W (Canada map 1:125,000: Ogden Bay NW 66/104); University of Minnesota Museum of Natural History Station 19; collected in 1953 and submitted by R. S. Taylor.	4140 ± 150
Y-269	*Missinaibi, Ontario: peat.* Peat, underlying 19 feet of till, clay, silt, and sand, on south bank of Missinaibi River, northern Ontario, 6 miles upstream from mouth of Soweska River; surface altitude 109 feet. Collected in 1954 by Owen Hughes and submitted by V. K. Prest. *Comment*: this peat is in the same stratigraphic position as peat from the James Bay interglacial deposits described by McLearn (*18*).	> 29,630
Y-270	*Missinaibi, Ontario: wood.* Wood from 3 feet below sample Y-269 in same section and below a layer of sandy till 2.9 feet thick. Collected in 1954 by Owen Hughes and submitted by V. K. Prest.	> 30,840
Y-271	*Opasatika River, Ontario.* Shell portion of shell-and-wood sample from below 6.2 feet of sand, overlying marine clay, 2.7 miles downstream from lower end of portage, Breakneck Falls, Opasatika River, northern Ontario; surface altitude 62.5 feet. Collected in 1954 by Owen Hughes and submitted by V. K. Prest. *Comment*: this sample dates the postglacial marine overlap in the James Bay region, and was expected to be younger than Y-269 and Y-270. Its great age may be spurious, for the sample was shell.	17,000 ± 370
Y-283 Y-284	*Prince Patrick Island, District of Franklin.* Driftwood from the Beaufort formation, fluvial and deltaic deposits lying unconformably on Paleozoic and Mesozoic rocks of Prince Patrick Island, Northwest Territories, with base ranging from near sea level to 530 feet.	
	Y-283: sample came from about 50 feet above the base of the formation at 380-foot altitude, lat. 76°38′N, long. 118°33′W, 6 miles north of Salmon Point, Intrepid Inlet.	> 25,300
	Y-284: sample came from near the base of the formation at 320-foot altitude, on the hill immediately E of Landing Lake. Both samples collected in 1954 by E. T. Tozer and submitted by A. L. Washburn.	> 31,840
Y-19	*Peary Land, Greenland.* Driftwood from a marine deposit at Brønlunds Fjord, Peary Land, northern Greenland, deposited in the interval between two glacial advances, after the second of which the sea level fell at least 65 meters. Collected and submitted by J. C. Troelsen.	5870 ± 100
	III. *Caribbean archeology*	
	A. *Saladero culture, Venezuela*	
Y-42	*Saladero 5.* Charcoal from level 6 (125 to 150 centimeters deep), section T2 (T2U2 side), excavation 7, Saladero site; Saladero culture (Rouse's Periods I and II). Collected in 1950 by J. M. Cruxent and Irving Rouse; submitted by Rouse (his lot S-5). *Comment*: this sample and the next two, Y-43 and Y-44, are all from a single, small midden, underlying a much larger deposit of Barrancas-culture refuse. They give an unexpectedly early date for the first appearance of agriculture and pottery in the eastern Caribbean.	2860 ± 130 2880 ± 130 (2520 ± 140)
Y-43	*Saladero 6.* Charcoal from level 6 (125 to 150 centimeters deep), section T3 (T3U3 side), excavation 7, Saladero site; Saladero culture. Rouse's lot S-6.	2700 ± 130
Y-44	*Saladero 7.* Charcoal from level 6 (125 to 150 centimeters deep), section T3 (center), excavation 7, Saladero site; Saladero culture. Rouse's lot S-7.	2570 ± 130
	B. *Barrancas culture, Venezuela*	
Y-38	*Barrancas 1–2.* Charcoal from levels 2 and 3 (25 to 75 centimeters deep), hearths 1 and 2, excavation 6, Saladero site; late Barrancas culture (Rouse's Period IV). Rouse's lots S-1 and S-12. *Comment*: these samples and the next two, Y-40 and Y-41, were intended to date the Barrancas-culture deposit overlying the midden of the Saladero culture and thus to provide a check on the upper limit of age of the latter, but for various reasons they have failed to do so (see Y-290). In the present instance, it would appear that the deposit has been disturbed in its upper levels by modern habitation, which is intensive on the site.	Modern (300 ± 50)
Y-40	*Barrancas 3.* Charcoal from level 7 (125 to 175 centimeters deep), section P1, excavation 6, Saladero site; early Barrancas culture (Period III). Rouse's lot S-3. *Comment*: this date is too early; it corresponds to those for the Saladero culture (Periods I and II), whereas the Barrancas culture is clearly later (Periods III and IV). Since the charcoal comes from the very bottom of the Barrancas-culture deposit, at the same depth below the surface (in excavation 6) as that of the Saladero midden (in nearby excavation 7), it is possible that the charcoal was laid down during the Saladero occupation of the site and before the Barrancas refuse began to accumulate.	2850 ± 120 (2710 ± 130)
Y-41	*Barrancas 4.* Charcoal from level 5 (100 to 125 centimeters deep), section T2 (T3U3 side), excavation 7, Saladero site; intermediate Barrancas culture (Period III). Rouse's lot S-4. *Comment*: this sample was prepared for solid-carbon counting and then reburned for acetylene counting; it was inadequate and had to be run at half the standard pressure. The inconsistency may thus be explained on chemical or physical grounds, but rechecking is not possible without new excavations.	6250 ± 380

Sample No.	Description	Age (years)
	C. *Ortoire culture, Trinidad*	
Y-260-1	*Ortoire 6–7.* Charcoal from levels 6 and 7 (100 to 140 centimeters deep), all sections, Ortoire site; Ortoire culture (Rouse's Period I). Collected in 1953 by John M. Goggin and Irving Rouse; submitted by Rouse (his lots O-6-7. *Comment*: the site is an isolated midden, pertaining to a single nonceramic culture. This sample was composed of lots from the bottom of each of two 20-centimeter levels; the two lots had to be combined to provide enough material for analysis. It and the sample that follows (Y-260-2) were intended as a check on the lower limit of the Saladero culture in Venezuela but are instead contemporary with it. Their dates are not implausible, however, since pottery and agriculture were doubtless present on the mainland before they reached the Indians of Trinidad.	2750 ± 130 (2420 ± 140)
Y-260-2	*Ortoire 5.* Charcoal from level 5 (80 to 100 centimeters deep), all sections, Ortoire site; Ortoire culture (Period I). Rouse's lot O-5. *Comment*: should have been slightly younger than the previous sample (Y-260-1), for it came from a higher level in the midden, but the difference in time was probably not great.	2760 ± 130
	D. *Irapa site, Venezuela*	
Y-290	*Irapa.* Charred bone from the Irapa site, Sucre Province; obtained 200 centimeters beneath the surface in a road cut on the Güiria highway. The accompanying pottery is a mixture of the Cedros and Palo Seco styles, as defined in Trinidad, with the latter predominant. Collected in 1951 by J. M. Cruxent and submitted by Irving Rouse. *Comment*: the site consists of a thin refuse deposit overlain by sterile soil. If the mixture of styles is not mechanical, the sample belongs to early Period III in Rouse's system, and thus can serve as a substitute for samples Y-38 to Y-41 in the problem of dating the upper time limit of Saladero culture.	1720 ± 50 1485 ± 90 1350 ± 80 Average 1580 ± 40
	IV. *Miscellaneous samples*	
Y-85	*Hekla H_5, Iceland.* Peat from layer 0.0 to 1.5 centimeters under ash layer H_5 (from Hekla eruption) in a bog 2 kilometers north of Akureyri, northern Iceland. Layer H_5 is the most extensive ash fall in Iceland, and from its stratigraphic relationship to the sub-Atlantic climatic deterioration its age was estimated as 2500 to 3000 years (*19*). Collected and submitted by Sigurdur Thorarinsson.	2720 ± 130
Y-87	*Laxá, Iceland.* Charcoal mixed with soil immediately beneath the younger Laxá lava flow just north of Laxá Canyon, northern Iceland. The stratigraphic relationship, in soil profiles, between this lava flow and the ash layer H_3 shows the flow to be younger, probably 700 years younger, thus providing the predicted age (*19*) of 1800 to 2300 years. Collected and submitted by Sigurdur Thorarinsson. *Comment*: another portion of this sample (K-139) has been dated by the Copenhagen laboratory as 2110 ± 140 years (*20*).	[1940 ± 270]
Y-86	*Hekla H_4, Iceland.* Peat from layer 0.0 to 1.5 centimeters under ash layer H_4, in the same locality as Y-85. Ash layer H_4 was once expected to be 4500 to 5000 years old (*19*); this figure was later revised to about 4000 years (*20*). Collected and submitted by Sigurdur Thorarinsson. *Comment*: this sample, which gave an age of 3300 ± 450 years by the solid-carbon method, was believed to be contaminated; on the assumption of a probable amount of contamination, its age was estimated as 4100 ± 450 years. It has not been remeasured, for another portion (K-140) has been dated by the Copenhagen laboratory as 3830 ± 120 years (*20*).	[4100 ± 450]
Y-249	*Seltjörn, Iceland.* Gyttja from the bottom of a peat profile in the Seltjörn (lagoon) near Reykjavik, the bottom layer being just at low water level; the sample dates the end of the postglacial isostatic crustal uplift. Its estimated age was more than 5000 years. Collected and submitted by S. Thorarinsson.	9030 ± 280
Y-204	*Wairau, New Zealand.* Charcoal from an earth oven of the Wairau pre-Maori moahunter culture, quadrate XI.A.4, 17 to 30 inches below surface. Collected in 1952 by R. R. Eyles and submitted by Roger Duff. *Comment*: Duff (*21*) has shown that the wholesale slaughter of moas occurred before the arrival of the Great Fleet in A.D. 1350, while dates from Pyramid Valley (*1*) (especially sample Y-129-A, 670 years) show that moas survived almost until this date, and until after the date of the Wairau site.	940 ± 110
Y-72	*Washington Island, Pacific Ocean.* Wood from the canoe found buried under 1.37 meters of peat in the central lagoon of Washington Island (lat. 4°43′N, long. 160°25′W) in 1906 and presented to the Bishop Museum, Honolulu, in 1917 (catalog No. B.1333). This canoe is unlike any known Polynesian type and has been thought to be possibly medieval Tongan in origin (*22*). Submitted by request by E. H. Bryan, Jr. and Peter Buck.	Modern (160 ± 100)

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News of Science

Nobel Prizes

The Royal Swedish Academy of Science has announced that Nobel prizes of $36,720 each will be awarded to the following research workers by King Gustaf Adolf on 10 Dec.:

Medicine. Hugo Theorell of the Nobel Medical Institute, Stockholm, Sweden, for discoveries on the nature and action of oxidation enzymes.

Chemistry. Vincent du Vigneaud of Cornell University, for his work with oxytocin and vasopressin [*Science* **118**, 543 (6 Nov. 1953)]. His synthesis of oxytocin was the first synthesis of a pituitary hormone.

Physics. Willis E. Lamb of Stanford University and Polykarp Kusch of Columbia University, jointly, for their work in atomic measurements. The two men used different techniques to arrive at identical conclusions that amended calculations for the energy level of hydrogen atoms that had been made by the British Nobel prize winner, P. A. M. Dirac.

Science and the Humanities

I. I. Rabi of Columbia University called for a greater understanding between scientists and humanists to combat a growing mood of anti-intellectualism in an address delivered at Harvard University on 21 Oct. Excerpts from Rabi's address follow:

"An epoch in history, our own, which has produced one of the greatest achievements of the human race, may be passing into a twilight which does not precede the dawn. There is an incipient mood of rejection of the greatest and most characteristic achievement of the age. Science, the triumph of the intellect and the natural faculties, has resulted in the hydrogen bomb; the glib conclusion is that science and the intellect are false guides. We must seek elsewhere for hope and salvation, but, say the same people, while doing so we must keep ahead of the Russians. . . . Keep the fearsome fruits but neglect the spirit of science. . . . [This] mood of anti-intellectualism . . . can only hasten the destruction which . . . people fear. Anti-intellectualism has always been endemic in every society. . . .

"What people are really looking for is wisdom. . . . Wisdom . . . is knowledge plus a quality which is within the human being. Without it knowledge is dry, almost unfit for human consumption, and dangerous in application. . . .

"Certainly the humanities preserve and create values; even more they express the symbolic, poetic, and prophetic qualities of the human spirit to the highest degree. Without the humanities we would not be conscious of our history; we would lose many of our aspirations and the graces of expression that move men's hearts.

"The humanities discern a part, a vital part of the life of man, but that is not all by any means. Man is made of dust and to dust returneth; he lives in a universe of which he is also a part. . . . To learn to understand himself he must learn to understand the universe. . . .

"To my mind the value content of science or literary scholarship lies not in the subject matter alone. . . . It lies chiefly in the spirit and living tradition in which these disciplines are pursued. The spirit is almost always conditioned by the subject. Science and the humanities are not the same thing; the subject matter is different and the spirit and tradition are different. Our problem in our search for wisdom . . . is to blend these two traditions in the minds of individual men and women. . . .

"Wisdom is by nature an interdisciplinary quality and not the product of a collection of specialists. . . . The greatest difficulty which stands in the way of a meeting of the minds of the scientist and nonscientist is the difficulty of communication, a difficulty which stems from some of the defects of education. The mature scientist . . . can listen with pleasure to the philosopher, the historian, the literary man or even to the art critic. . . . He reads the newspapers, magazines, books, listens to music, debates politics, and participates in the general activities of an educated citizen.

"Unfortunately this channel of communication is most often a one-way street. The nonscientist cannot listen to the scientist with pleasure and understanding. Despite its universal outlook and its unifying principle, its splendid tradition, science seems to be no longer communicable to the great majority of educated laymen. . . . To his colleagues in the university the scientist tends to seem more and more as a man from another planet, a creature uttering profound but incomprehensible truths, or a creature scattering antibiotics with one hand and atomic bombs with the other.

"The problems are, of course, depressingly difficult. There are firstly the problems connected with the secondary schools—their overcrowding; their teachers, overworked and inadequately trained; the school boards; and not least the powerful clique of professional educators who form a society within our society. All that is unique and characteristic of science and mathematics is being crowded out of the curriculum and replaced by a fairy tale known as general science. The colleges and universities are in much better shape although the great wave of the rising waters of population increase is about to hit them, with the force of a New England hurricane, with masses of inadequately prepared students.

"Wisdom can achieve a hybrid vigor by crossing the scientist and the humanist through a more extensive and intensive interaction within the faculty. Why should not the professor of physics be expected to refresh himself every 7 years . . . by taking a course in esthetics, comparative literature, or the Greek drama? Why shouldn't the professor of medieval philosophy or the professor of ancient history take a course in modern physics and become acquainted with the profound thoughts underlying relativity and quantum mechanics? By taking in one another's wash, we might all become cleaner and more wholesome."

Pilot Project in Teacher Education

Arlington, Va., has offered itself as a model for a pilot study under which science and mathematics teachers will have access to supplementary training through a program initiated by the National Academy of Sciences–National Research Council. In addition, other school systems in the Washington, D.C., area have been invited to participate.

In Arlington, the school board, the Parent-Teachers Association, and civic groups will cooperate to raise a scholarship fund that will enable teachers to take graduate-level courses both in fundamentals and in recent developments in science and mathematics. Local universities, including George Washington University, the University of Virginia, American University, Georgetown University, Catholic University, Howard University, and the District of Columbia Teachers College, are cooperating to develop new courses in mathematics, physics, chemistry, and biology that will be offered jointly in the summer of 1956.

Further, the program will provide teachers with opportunities for summer

employment in nearby industrial and governmental scientific and engineering organizations. Additional plans call for the provision of aids to guidance and career counseling, seminars, invitational lectures for teachers and students by outstanding scientists and engineers, and gifts and loans of laboratory equipment.

Responsibility for the conduct of the new program will be assigned to a special board representing all areas of science, mathematics, and engineering. Staff assistance to the board is under the direction of John S. Coleman, executive secretary of the Academy-Research Council's division of physical sciences.

The Arlington County pilot study is to be carried out with the cooperation of the AAAS and with the encouragement of major groups in business and industry. John R. Mayor, director of the AAAS Science Teaching Improvement Program, is working closely with Coleman in the development of the study.

News Briefs

The ten astronomical highlights of 1955 as selected by Harlow Shapley, former director of Harvard College Observatory, are as follows:

1) Announcement that the U.S. Government would sponsor the launching of at least one small artificial satellite during the International Geophysical Year, which starts on 1 July 1957.

2) Detection of "thunderbolts of Jove" or some similar strong electric effect in the atmosphere of the planet Jupiter by Bernard F. Burke and Kenneth L. Franklin of the Carnegie Institution of Washington. They discovered the radio waves from Jupiter, the first to be found from another planet in the solar system, using a radiotelescope located at Seneca, Md. The radio signals have been verified by Australian observers.

3) Discovery of the star of smallest known mass—only one-twelfth that of the sun—by Sarah Lee Lippincott of Sproul Observatory, Swarthmore, Pa. Walter Baade of Mount Wilson and Palomar Observatories photographed the discovery, which is one component of a dwarf reddish double star, by aiming the 200-inch telescope exactly where Lippincott had calculated Ross 614-B would be.

4) Renewal of discussion, in connection with the satellite program, of who owns the upper air and who has the right of way in space beyond the upper air.

5) Conclusion of a 50-year research program by many Harvard astronomers on variable stars of the Magellanic Clouds. The analysis included 3000 variable stars, three-fourths of which are Cepheids. For 1220 of them, periods and light curves have been determined.

6) Positive identification of the strong yellow line in the sun's corona as that of calcium XV, caused by calcium atoms stripped by ionization of 14 of their 20 electrons. Identification was made by Walter O. Roberts and his associates at the University of Colorado's High Altitude Observatory, and by David Layzer of Harvard.

7) The report by E. C. Slipher of Lowell Observatory, Flagstaff, Ariz., on his 10,000 photographs of the planet Mars in red, yellow, and blue light, made during 1954, when Mars was relatively close to the earth, with the University of Michigan's telescope on Naval Hill, Bloemfontein, Union of South Africa. Also, a report by Audouin and Charles Dollfus on their photoelectric observations, made from a balloon 4.5 miles above the earth's surface, of the small moisture content of the Martian atmosphere.

8) Appearance of the first section of the two-color star and galaxy atlas, which was made with the 48-inch Schmidt telescope under the auspices of Mount Wilson and Palomar Observatories and the National Geographic Society, with important technical assistance from the Eastman Kodak Company's research laboratories.

9) Occurrence on 20 June of a solar eclipse with the greatest duration of totality, 7 minutes 7.8 seconds, since A.D. 717. It will be nearly 200 years before such a long eclipse occurs again.

10) An explanation by C. F. von Weizsaecker of the reason for the sphericity of globular clusters and their freedom from interstellar dust and gas. His theory is that dust and gas have been cleaned out by frequent passage of the clusters through nebulosities in the Milky Way.

■ Discovery of the bodies of insects some 60 million years old imbedded in samples of Alaskan amber has been reported by the Arctic Institute of North America. Although fossil impressions of older insects exist, the mummified Alaskan animalcules are believed to be many millions of years older than any other insect specimens extant.

The Arctic Institute was sponsor of the successful search for Cretaceous insect relics that was conducted by Robert L. Usinger and R. F. Smith, professors of entomology at the University of California. Bedrock sources of Alaskan amber had been discovered within the past few years by the U.S. Geological Survey, but it was not until last summer that Usinger and Smith, acting on information provided by the Survey, extracted pieces of amber for study and examination. The amber was found in the Colville River valley and along the Kuk River, on the northern slope of the Brooks Range about 150 miles north of the Arctic Circle.

Ancient insects have been preserved in amber over the centuries because they became trapped in the resinous matter from which amber is formed. All the great amber deposits of the world (with one exception) are from the Oligocene epoch of some 30 to 40 million years ago. But Alaskan amber, according to specialists of the U.S. Geological Survey, unquestionably dates from Cretaceous time, and any insect specimens it contains may contribute materially to entomology and to the general field of evolution. Detailed study will be required to determine the nature of the insects in the amber samples brought home by Usinger and Smith, but preliminary examination has revealed that they contain specimens in a fine state of preservation. The field work in Alaska was based at the Arctic Research Laboratory of the Office of Naval Research at Point Barrow.

■ In the 1 Sept. issue of *Umschau*, G. Jaeger of Degussa, Frankfort, Germany, presents a brief report of a new synthetic gem that simulates lapis lazuli. The material is made by sintering spinell that is colored blue by the addition of cobalt. The resulting synthetic gem has a much greater Mohs hardness, 8 to 8½, than a natural lapis lazuli and its color is not affected by either heat or light.

■ The Slovenian Academy of Sciences and Arts has released the second series of reports of the J. Stefan Institute of Physics in Ljubljana, Yugoslavia. The new institute, erected in honor of the Austrian physicist who first stated the law that the total radiation from a black body is proportional to the fourth power of its absolute temperature, is now equipped with a 31-Mev betatron, a 2-Mev van de Graaf accelerator, and a neutron generator that uses the deuterium-tritium reaction as a neutron source.

The institute also has the auxiliary instruments and facilities necessary for research in cosmic rays and nuclear physics, such as mass spectrometers, counters, and a nuclear-plate laboratory. In addition, work on physicochemical problems is in progress.

■ People in the farm states of the midwest live longer than those in other areas of the United States, according to a report by the Metropolitan Life Insurance Company. Expectation of life at birth in the West North Central area at midcentury was 67.8 years for white males and 73.3 years for white females. The next best record for males is found in New England—66.9 years—and for females, on the Pacific Coast—72.9 years.

Average length of life increased substantially in every section of the country during the decade of the 1940's, according to life tables computed by statisticians from data provided by the National Office of Vital Statistics and the Bureau of the Census. The largest gains were made in the areas that formerly had the least favorable records. For example, in the Mountain States the increases were 4.4 years for white males and 5.9 years for white females. This compares with increases of 2.6 and 4.1 years, respectively, in the West North Central region.

■ The Navy is testing a miniature meteorological instrument that can substitute for permanent weather stations. The device is designed to record data automatically in both total darkness and under severe weather conditions. It weighs 6 pounds and is 23 inches high.

The instrument measures and records surface atmospheric pressure, temperature, relative humidity, wind speed, and wind direction. The equipment was developed for the Navy Bureau of Aeronautics by the Friez Instrument Division of the Bendix Aviation Corporation.

■ The World Health Organization, as one of the specialized agencies of the United Nations, helped to promote the celebration of United Nations Day on 24 Oct. This was the tenth anniversary of the day on which the U.N. Charter came into force in 1945.

The operations of WHO are now decentralized in six regional offices. In the western hemisphere the Pan American Sanitary Bureau serves also as WHO's regional office for the Americas. In the October issue of the *United Nations Review*, M. G. Candau, director-general of WHO and formerly assistant director of the Pan American Sanitary Bureau, reviews the work of WHO and PASB in an article entitled "The role of health in guaranteeing a secure world."

Scientists in the News

HAROLD S. VANCE, former chairman of the executive committee of the Studebaker-Packard Corporation, South Bend, Ind., was sworn in as a member of the U.S. Atomic Energy Commission on 31 Oct. Vance's interim appointment for the term ending 30 June 1960 was announced recently by President Eisenhower.

Six Albert Lasker awards for outstanding achievement in medical research and public health administration have been announced by the American Public Health Association in New York. Presentation of the $1000 prizes will be made on 17 Nov. during the 183rd annual meeting of the APHA in Kansas City, Mo. Given for the 10th year and considered among the nation's highest medical honors, the 1955 Lasker awards will be conferred on:

KARL PAUL LINK, professor of biochemistry, University of Wisconsin, for "fundamental contributions to our understanding of the mechanism of blood clotting and for the development of methods for the improved treatment of thrombo-embolic conditions." Link is the discoverer of the anticoagulant, dicumarin.

ROBERT D. DEFRIES, director, Connaught Research Laboratories, University of Toronto, Canada, for "distinguished leadership" in the development of preventive medicine and public health in Canada. Connaught, under Defries, prepared and supplied nearly all the virus used in the field trials of the Salk poliomyelitis vaccine in 1954.

C. WALTON LILLEHEI, associate professor of surgery, University of Minnesota, jointly with MORLEY COHEN, HERBERT E. WARDEN, and RICHARD L. VARCO, of the same institution, for "advances in cardiac surgery making possible more direct and safer approaches to the heart." Lillehei and his associates originated the "cross-circulation" surgical technique for the correction of congenital heart defects.

Menninger Foundation and Clinic, Topeka, Kan. group award citing KARL A. and WILLIAM C. MENNINGER for "a sustained and highly productive attack against mental diseases, bearing fruit in better hospitals, better trained staffs and greatly improved care of the patient."

Nursing Services of the U.S. Public Health Service, Washington, D.C., group award citing LUCILE PETRY LEONE, PEARL MCIVER, and MARGARET ARNSTEIN, for "distinguished contributions to the advancement and well-being of the nation" through their leadership in public health nursing.

A team of tuberculosis researchers, group award to WALSH MCDERMOTT and CARL MUSCHENHEIM, New York Hospital–Cornell University Medical Center, New York, EDWARD H. ROBITZEK and IRVING J. SELIKOFF, Seaview Hospital, New York, together with Hoffmann-La Roche Research Laboratories, Nutley, N.J., and The Squibb Institute for Medical Research, New Brunswick, N. J., for "contributions of the first order to our knowledge of the principles of the treatment and control of tuberculosis" with the isoniazid drugs.

SAMUEL L. MEYER, head of Botany and director of the Marine Station of Florida State University, has resigned those posts to become dean of Central College, Fayette, Mo.

W. MALCOLM REID has joined the poultry department at the University of Georgia to carry out a research program in poultry parasitology. Reid recently returned from Egypt, where for 3 years he was head of the Poultry Unit under the Point Four program.

RONALD N. BRACEWELL has been appointed associate professor of electrical engineering at Stanford University. He was a research officer for a number of years with the Commonwealth Scientific and Industrial Research Organization at Sydney, Australia; last year he served as a visiting faculty member at the University of California.

MERVIN J. KELLY, president of Bell Telephone Laboratories and GORDON RADLEY, director general of the British Post Office, were selected by the City of Genoa, Italy, to receive the first Christopher Columbus International Communication prize, which was conferred in Genoa on Columbus Day. Kelly and Radley received the prize in recognition of "the planning, now being placed into practice, of the submarine telephone cable which will make it possible to establish 36 telephone circuits across the Atlantic between Scotland and Canada with extension to New York, 'intending furthermore to reward hereby the numerous scientists, research workers and engineers who have contributed in the planning, production and placing in operation of the intercontinental submarine telephone line.'"

HOWARD F. HUNT has been appointed chairman of the University of Chicago department of psychology. A member of the faculty since 1948, Hunt specializes in animal psychology. He has done extensive work on the psychological and physiological effects of electroconvulsive shock treatment in animals.

JOHN S. BURLEW has been named director of the Franklin Institute, Philadelphia, Pa. HENRY B. ALLEN continues as executive vice president and secretary. Burlew joined the institute in July of 1954 from the Cambridge Corporation, Cambridge, Mass., where he was technical director.

EDGAR C. BRITTON, director of the Edgar C. Britton Research Laboratory of the Dow Chemical Company, Midland, Mich., and past president of the American Chemical Society, is to receive the highest award in American industrial chemistry, the Perkin medal of the American Section, Society of Chemical Industry. The award will be the 50th impression of the Perkin medal, which is bestowed annually for outstanding

achievement in applied chemistry in the United States.

Established in 1906, the medal honors Sir William Henry Perkin and commemorates his discovery of the first synthetic dye in 1856. The 1956 medal will be presented to Britton in September 1956 at a dinner in his honor that will form part of the centenary celebration of Perkin's synthesis. Perkin's contributions provided a base for the synthetic dye industry.

Britton is honored for many outstanding contributions to industrial organic chemical development. His early work on the synthetic production of phenol made this raw material abundantly available for a large segment of the plastics industry. Derivatives also form such products as weed killers, insecticides, fungicides, and preservatives.

Britton also was a pioneer in the commercial development of silicone resins, the basis for an entirely new industry. Dow Corning employed his processes in making the first high-temperature silicone resin insulation for airplane engines. Subsequently the company produced silicone products for tanning leather, lens cleaners, polishes, and lubricants, as well as silicone rubber.

Agriculture is indebted to Britton not only for his development of phenol derivatives, but also for his synthesis of eight of the essential amino acids; seven of these are being studied as food supplements for man and animals. One of them, methionine, is the only essential amino acid now in commercial production; it is widely used in feed supplements, particularly for poultry.

CECIL H. WADLEIGH, career scientist and administrator in the U.S. Department of Agriculture, has been named chief of the soil and water conservation research branch of the Agricultural Research Service. He fills a position that has been vacant since the death of Robert M. Salter in September.

In his new post, Wadleigh will direct and coordinate USDA soils research in 41 States, representing all important soils regions of the United States. Headquarters of his branch are at the USDA Plant Industry Station, Beltsville, Md.

WARREN C. JOHNSON, professor and chairman of the University of Chicago department of chemistry, became dean of the division of physical sciences on 1 Nov. He succeeds Walter Bartky, who last June was appointed vice president of the university in charge of special scientific programs.

THOMAS N. A. JEFFCOATE, professor of obstetrics and gynecology at the University of Liverpool, Liverpool, England, is visiting professor this month at the State University of New York College of Medicine in Brooklyn. He also delivered the Sir Arcot Mudaliar Lectures in Madras, India, this year and has recently completed a visiting professorship at the Royal Prince Albert Hospital in Sydney, Australia.

The following are among those who have recently received honorary doctoral degrees from Drexel Institute of Technology: ROGER ADAMS, head of the department of chemistry, University of Illinois; GEORGE R. HARRISON, dean of science, Massachusetts Institute of Technology; C. GLEN KING, executive director, Nutrition Foundation; GEORGE P. LARRICK, Commissioner of Food and Drugs; HOWARD A. MEYERHOFF, executive director, Scientific Manpower Commission; ALEXANDER C. MONTEITH, vice president, Westinghouse Electric Corporation; C. GUY SUITS, vice president and director of research, General Electric Company; ROBERT E. WILSON, chairman of the board, Standard Oil Company (Indiana).

Necrology

WILLIAM J. CROZIER, Belmont, Mass.; 63; professor of general physiology at Harvard University and research authority on human vision; 2 Nov.

JULIUS H. HESS, Chicago, Ill.; 79; professor emeritus of pediatrics at the University of Illinois College of Medicine; 2 Nov.

NORMAN D. HUMPHREY, Detroit, Mich.; 44; professor of anthropology at Wayne University; 30 Oct.

HOWARD M. MARJERISON, Boston, Mass.; 59; specialist in preventive dentistry and lecturer at Harvard University; 4 Sept.

JOHN C. TRACY, New Haven, Conn.; 86; professor emeritus of civil engineering at Yale University; 1 Nov.

Education

■ The Atomic Energy Commission has approved the loan of 2 tons of natural uranium metal and a neutron source to New York University for use in constructing a facility for a nuclear engineering education program. The university will use the material in a subcritical assembly—a facility in which a neutron flux can be produced, but which is incapable of sustaining a nuclear fission chain reaction. The assembly will consist of an arrangement of natural uranium metal rods in ordinary water. If a neutron source is introduced, nuclear fissions occur in the assembly, but the reaction cannot be sustained without the presence of the neutron source.

The facility requires no controls and will be safe at all times. Neither expensive shielding nor heat removal equipment will be necessary. It may be used for many laboratory exercises in nuclear engineering.

Simultaneously, the AEC announced that it has approved a policy of assistance to nonprofit educational institutions interested in establishing programs using subcritical nuclear assemblies. Such assistance will consist of supplying certain materials for assemblies without a use charge being made, subject to availability and to a deetrmination that such materials loans will result in a net advantage to the commission's program. The plan is designed to help to alleviate the current shortage of nuclear scientists and engineers.

■ Sixty-six students have been accepted for the second session of the new School of Nuclear Science and Engineering in Lemont, Ill., which opened on 7 Nov.; 45 are from foreign countries and 21 from the United States. The school is operated for the U.S. Atomic Energy Commission by the Argonne National Laboratory. It is one of the major projects undertaken by the AEC in cooperation with the State Department and the International Cooperation Administration in support of President Eisenhower's atoms-for-peace program.

Twenty-one nations are represented among the foreign enrollees. Of the U.S. students, 18 are sponsored by American industry and three are from the AEC. Plans are under way for a third session to begin next spring.

The second class, like the first, represents a cross section of scientists and engineers from Europe, Latin America, and the Near, Middle, and Far East, and brings the total of foreign enrollees for the two sessions to 75 persons from 29 countries.

Listed for the first time are students from Burma, Chile, the Republic of China, the Federal Republic of Germany, India, Iraq, Italy, Lebanon, Norway, and Turkey. Nations having students at both sessions are Belgium, Egypt, France, Israel, Japan, Mexico, Pakistan, the Philippines, Spain, Sweden, and Thailand.

Most of the new students arrived in Washington, D.C., on 31 Oct. for a week of general orientation under the direction of the International Cooperation Administration. They were given background lectures on U.S. history and culture and on atomic energy. The School of Nuclear Science and Engineering has a full-time faculty headed by Norman Hilberry, deputy director of Argonne National Laboratory. J. Barton Hoag, who is on leave from the U.S. Coast Guard Academy, is associate director.

The regular instruction is supplemented by lectures on specialized topics by members of the Argonne National Laboratory staff. Also there are occasional lectures by staff members of other AEC installations and by scientists and engineers in the nuclear and related fields.

In general, the curriculum is concerned with (i) production of reactor materials; (ii) design, construction, and operation of research and material-testing reactors; (iii) equipment and procedures for conducting research and development with these reactors; (iv) handling and processing of irradiated materials produced in research and materials-testing reactors; (v) utilization of the radioactive products of reactors; and (vi) principles of design, construction, and operation of nuclear power plants.

■ A $59,650 Kellogg Foundation grant has been awarded to the University of Minnesota for further development of its course in hospital administration. The grant is to be used over a 3-year period for research work in hospital administration, integration of the on-campus and off-campus teaching programs, and preparation of textbook material.

Edith Lentz, who has just completed a 5-year Kellogg Foundation study of hospital personnel at Cornell University, will be the course's first director of research. Bruce Butters, an alumnus of the Minnesota hospital administration course who has recently returned from 3 years in the Army Medical Corps, will assemble materials for textbooks.

■ The University of Michigan board of regents has approved the division of one of the departments in the College of Engineering into two separate units and discontinuance of the department of production engineering. The present department of mechanical engineering will be divided into the department of mechanical engineering and the department of industrial engineering. All of the changes will become effective during 1956–57.

Under the change, the personnel, budget and other resources of the department of production engineering will be distributed between the reorganized department of mechanical engineering and the department of chemical and metallurgical engineering. The reorganization is expected to strengthen the curricula in industrial, mechanical, and metallurgical engineering.

Grants, Fellowships, and Awards

■ Recognizing that geography in America suffers because few American geographers are doing field research in foreign areas, the National Academy of Sciences–National Research Council has initiated a program of support to enable young geographers to carry out field investigations abroad. Preference will be given to projects that involve at least 5 months of foreign residence.

Funds will be made available not only to geographers but also to scientists in related fields whose research topics are closely allied to geography. Financial support is provided by the U.S. Office of Naval Research. The NAS-NRC Division of Earth Sciences is appointing a committee to screen all applications.

■ The Mycological Society of America has announced that it will receive applications for the newly established graduate fellowship in mycology. This fellowship will be awarded for 1956–57 and carries a stipend of $750. Eligible candidates must be predoctoral students in residence at the institution where they are registered.

Forms for application may be obtained after 1 Jan. from the secretary-treasurer of the society, Dr. C. J. Alexopoulos, Department of Botany and Plant Pathology, Michigan State University, East Lansing, Mich. Applications are due *by 15 Feb. 1956.*

■ Nominations are solicited for the 1956 award and a gold medal made available by the Borden Company Foundation, Inc. The American Institute of Nutrition will make this award in recognition of distinctive research by investigators in the United States and Canada that has emphasized the nutritive significance of the components of milk or of dairy products. The award will be made primarily for the publication of specific papers during the previous calendar year, but the jury of award may recommend that it be given for important contributions made over a more extended period of time, not necessarily including the previous calendar year.

The award is usually given to one person, but if in their judgment circumstances and justice so dictate, the jury may recommend that it be divided between two or more collaborators in a given research project. The jury may also recommend that the award be omitted in any given year if in its opinion the work submitted does not warrant the award. Membership in the American Institute of Nutrition is not a requisite of eligibility for the award. Employees of the Borden Company are not eligible for this honor.

Nominations should be accompanied by such data relative to the nominee and his research as will facilitate consideration for the award. The formal presentation will be made at the annual meeting of the institute in the spring of 1956. To be considered for the award, nominations *must be submitted by 1 Jan. 1956* to the chairman of the nominating committee, Gladys Everson, Department of Home Economics, University of California, Davis.

■ The American Foundation for Pharmaceutical Education annually offers three cash awards of $250 each for meritorious papers in pharmacognosy, published or unpublished. An award will be made to one competitor in each of the following groups: (i) undergraduate students in accredited colleges of pharmacy; (ii) graduate students in accredited colleges of pharmacy; and (iii) teachers, research workers, and industrial scientists.

The papers submitted must be principally within the fields of morphologic, taxonomic, or cytogenetic pharmacognosy, or in drug-plant cultivation or commercial pharmacognosy. Phytochemical aspects of the work may be included in conjunction with discussion in one or more of the aforementioned fields. Each paper must contain some new information ascertained from studies made by the contestant on (i) one or more medicinal, pesticidal, allergenic, poisonous, or aromatic plants; or (ii) one or more cellular drugs, pesticides, adulterants, or substituents thereof; or (iii) methods of quantitative microscopical analysis as applied to the determination of the percentage of an adulterant in a natural cellular drug, condiment, or pesticide; or (iv) the cytology or genetics of a medicinal plant; or (v) the cultivation of one or more drug plants.

For information write to: Dr. H. W. Youngken, Massachusetts College of Pharmacy, Longwood Ave., Boston 15, Mass. *All entries must be received by 1 Feb.*

■ The Division of Biological and Medical Sciences of the National Science Foundation has announced that the next closing date for receipt of research proposals in the life sciences is *1 Feb. 1956.* Proposals received prior to that date will be reviewed during the spring meetings of the advisory panels, and final disposition will be made approximately 10 weeks from the dates of those meetings. Proposals received after 1 Feb. 1956 cannot be reviewed until the following fall.

■ Twenty-eight fellowships are offered by the American Association of University Women to American women for advanced study or research during the academic year 1956–57. In general, the $2000 fellowships are awarded to young women who have completed residence work for the Ph.D. degree or who have already received the degree; more mature scholars receive $2500 to $3500 awards. Most of the fellowships are un-

restricted as to subject and place of study.

Applications for all fellowships, together with supporting materials, must reach the AAUW office in Washington, D.C., *by 15 Dec.* For detailed information, address the Secretary, Committee on Fellowship Awards, AAUW, 1634 I St. NW, Washington 6, D.C. Requests for application forms should include statement of academic status.

■ The Link Foundation will hold its annual meeting of the board of trustees and technical assistance board 16–17 Dec. Meeting participants will review requests for grants. The primary purpose of the Link Foundation, which has headquarters at the Smithsonian Institution in Washington, D.C., is to make grants available to nonprofit institutions and associations for projects that advance education and training in aeronautics. Organizations interested in submitting grant applications *should do so by 1 Dec.*

■ The Public Health Service has announced ten grants totaling $295,367 to start a special program of research into air pollution problems. It is hoped that these and other studies will answer many puzzling questions and help eliminate many of the dangers from air pollution. The grants were awarded by the Surgeon General on recommendations of the National Advisory Health Council from a $500,000 fund appropriated by the Congress for the Department of Health, Education, and Welfare.

These grants, which are administered by the National Institutes of Health, have been awarded to the University of Cincinnati (2 awards), Detroit Department of Health, University of Southern California (2 awards), Utah State Agricultural College, Jefferson Medical College, Harvard School of Public Health, University of Michigan, and the University of California.

■ Nine postgraduate fellowships will be awarded by the Minneapolis-Honeywell Regulator Co. for 1955–56. The awards include a new fellowship in engineering or physics at the University of Pennsylvania and establishment of a second engineering or physics grant at Iowa State College.

Now in its tenth year, the Honeywell fellowship program provides tuition and living allowance awards to outstanding graduate students who need financial assistance to continue their studies. Grants range from $1200 to $2700, depending on the school's tuition.

Other awards to be made by the company for the current academic year include two to the institute of technology or the department of physics at the University of Minnesota; one in the electrical engineering servomechanisms laboratory at Massachusetts Institute of Technology; one in engineering or physics at Purdue University; one in plastics and chemical technology at North Dakota State College; and one awarded through Tau Beta Pi, honorary engineering fraternity.

■ The University of Cincinnati's Institute of Industrial Health is offering graduate fellowships in industrial medicine to graduates of approved medical schools who have completed 1 year of internship. The 3-year course of instruction, leading to the degree of doctor of science in industrial medicine, satisfies the requirements for certification in occupational medicine by the American Board of Preventive Medicine. Two years are devoted to intensive academic and clinical study in the field of industrial medicine. A final year is spent in residency in an industrial medical department or in some comparable organization.

Stipends for the first 2 years vary from $3000 to $4000, depending on marital status. In the final or residency year a fellow is compensated by the organization in which he is completing his training.

A 1-year certificate course, without stipend, is also offered to qualified applicants. Requests for additional information should be addressed to Secretary, Institute of Industrial Health, College of Medicine, Eden and Bethesda, Cincinnati 19, Ohio.

Miscellaneous

■ The proceedings of the pre-Geneva conference on peaceful uses of atomic energy that was held by the Academy of Sciences of the U.S.S.R., 1–5 July, will be published in English before the end of this year by the Consultants Bureau, 259 W. 14 St., New York 11. The proceedings of this conference are comprised of 87 reports that do not duplicate reports by Soviet participants in the Geneva conference. The translation will appear in four volumes—physics, chemistry, biology, and technology—with the appropriate plenary session reports incorporated in each volume.

Publication of the set will be completed before the end of 1955. The translation will be by bilingual scientists in the respective fields, and will include all diagrams, photographs, and tabular material.

The publication dates and prepublication prices for the separate volumes of the *Proceedings of the Conference of the Academy of Sciences of the USSR on the Peaceful Uses of Atomic Energy, July 1–5, 1955* are as follows: *Sessions of the Physico-Mathematical Division*—15 Nov., $150; *Sessions of the Chemical Division*—1 Dec., $125; *Sessions of the Biology Division*—15 Dec., $125; *Sessions of the Technology Division*—30 Dec., $100. A complete set of the four volumes will cost $350.

Orders for the set or for individual volumes that are received by the publishers on or before 30 Dec. 1955 will be filled at the prepublication prices. Standard price of the translation has not been definitely established, but will be at least 15 percent more than the prepublication price.

■ Scientific workers who are planning field work in the Melanesian, Indonesian, Philippine, Micronesian, or Polynesian areas, will be interested to know that the *Gloria Maris,* a 107-foot, steel-hulled, two-masted auxiliary schooner, is now available for charter in that area. The *Gloria Maris,* which is on long-term charter to the Natural Science Foundation in Philadelphia, Pa., can be subchartered on a bareboat basis provided that her permanent skipper and his crew are engaged separately. Special charter rates are offered to scientific groups.

The *Gloria Maris* recently completed an expedition in the Palau Islands for the purpose of collecting marine mollusks under the auspices of the Academy of Natural Sciences of Philadelphia and the Natural Science Foundation. She is temporarily based at Koror in the Palau Islands, subject to further mollusk collecting trips under the same auspices or such charters as can be arranged. The vessel can accommodate a scientific party of 8 to 10 individuals in comfort and has space and facilities for scientific work.

The Natural Science Foundation would also be interested in locating individual scientists who might arrange to accompany future marine mollusk collecting expeditions in order to do field work in their own specialties in South and West Pacific areas. The foundation would consider providing board and lodging on the *Gloria Maris* for those able to provide their own transportation to and from the area. For information write to R. Tucker Abbott, Academy of Natural Sciences of Philadelphia, 19th and the Parkway, Philadelphia 3, Pa.

■ Juan Hector Hunziker, Instituto de Botanica, Araos 2875, Buenos Aires, Argentina, wishes to obtain viable seeds of North American species of the genus *Ephedra.* Those able to furnish such seeds should send them to Hunziker, at the above address, preferably by air mail.

Reports and Letters

Action of Parapyruvate on Early Development of Strongylocentrotus Purpuratus

The metabolic sequence followed by the sea urchin egg during its early development is not known with certainty, although the change in oxygen uptake on fertilization, first described in 1908 (*1*), has been studied by numerous workers (*2*). The presence of the conventional glycolytic pathway and of the enzymes of the Krebs tricarboxylic acid cycle has been demonstrated in unfertilized eggs (*3*), and oxidative phosphorylation has been demonstrated in cell-free particles (*4*). However, the importance of the tricarboxylic acid cycle as a metabolic pathway in early development of sea urchin embryos has not been determined. If the cycle functions as a major source of high energy phosphate during this period, it is possible that specific inhibitors might have some effect on sea urchin morphogenesis. Accordingly, the effects of parapyruvate, a specific inhibitor of the α-ketoglutaric oxidase (*5*), on the early development of *Strongylocentrotus purpuratus* were investigated (*6*).

Fertilizable eggs from several ovaries were pooled, strained through cheese cloth, washed, and allowed to stand in sea water (10°C) for 6 hours before they were divided into the various cultures and fertilized. Freshly fertilized eggs were washed essentially free of excess sperm. Embryos were cultured in shallow dishes on a rocking device where they were kept in constant gentle agitation throughout the experiment. At appropriate intervals the culture fluid was replaced with fresh medium. Test cultures were fertilized and grown in the inhibitor solutions made up in sea water and adjusted to the normal *p*H of the sea water.

The effects of 25-millimolar parapyruvate were as follows. (i) *Fertilization.* Fertilization was normal in both the controls and in the cultures grown in parapyruvate. (ii) *Cleavage through the 32-cell stage.* There was no obvious difference in the rate and appearance of cleavage in the cultures grown in parapyruvate and in the controls. However, at the 32-cell stage almost all of the fertilization membranes of the parapyruvate cultures were badly wrinkled and many had disappeared, although the membranes in the controls were intact. (iii) *Early blastulae.* The blastulae of the control and the parapyruvate cultures looked identical except for fertilization membranes that were intact in the controls but missing from more than 50 percent of the parapyruvate cultures. (iv) *Late blastulae.* The blastulae of all cultures had hatched and were actively moving. Those of the control cultures were becoming oval with a marked thinning of the blastula wall and were developing a conspicuous aggregation of primary mesoderm. Those of the parapyruvate cultures still resembled early blastulae in that the embryos were quite spherical, had a relatively thick wall, and had developed no mesoderm. (v) *Early gastrulae.* The control cultures had commenced to gastrulate. The archenteron was indented about one-eighth the diameter of the blastocoel and the primary mesoderm was well developed. The parapyruvate cultures were essentially still blastulae, except that primary mesoderm was now visible. (vi) *Mid to late gastrulae.* When the control cultures had completed gastrulation, the parapyruvate cultures were only very early gastrulae, with the archenteron merely a slight depression. Twenty-four hours later there had been no further development in these parapyruvate cultures.

Eggs that had been placed in 25-millimolar parapyruvate for 1 hour before fertilization, and that were cultured in parapyruvate, developed in an identical manner to that just described. Eggs kept in 25-millimolar parapyruvate for 6 hours prior to fertilization, and cultured in parapyruvate, failed to form an archenteron although some primary mesoderm was developed. Cultures in 5-millimolar parapyruvate were almost identical with the control cultures. Cultures grown in 25-millimolar fluoroacetate, which blocks the aconitase reaction in the tricarboxylic acid cycle (*7*), developed as did those that were incubated for 6 hours prior to fertilization and grown in 25-millimolar parapyruvate.

Thus it appears that these inhibitors prevent differentiation and arrest the development of sea urchin embryos in the late-blastula to early-gastrula stage. A similar suppression of development in the blastula stage of sea urchins owing to the addition of thiocyanate was described as early as 1896 (*8*). This arrested development was preceded by a depression of respiration before the morphological differences between the control cultures and those grown in thiocyanate became apparent (*9*). Iodosobenzoate inhibits archenteron formation (*10*), and it has been suggested (*11*) that this is caused by inhibition of the selective distribution of mitochondria involved in gastrulation. The late blastula stage seems to be characterized by increased metabolic activity antecedent to differentiation. There is a sudden increase in mitochondrial number (*12*) and a major increase in protein synthesis (*13*) coinciding with a period of increased respiration (*14*).

Perhaps cleavage in the sea urchin is independent of the tricarboxylic acid cycle since the cycle inhibitors used in this study had no detectable effect until the blastula stage. The fact that parapyruvate had no apparent effect prior to differentiation involving gastrulation might indicate a change in the metabolism of the blastula whereby the tricarboxylic acid cycle becomes a necessary pathway; thus, further development would be depressed by cycle inhibitors. The increased protein and enzyme synthesis necessary for differentiation may possibly require the cycle. Before the blastula stage the cycle may function at a comparatively low level, but during the blastula stage it may enter a phase of activity geared to the increased metabolic requirements. An alternative to this hypothesis is that the tricarboxylic acid cycle does operate during the early stages and actually is blocked by parapyruvate, but its function is to produce a store of high energy phosphate only utilized later during periods of synthesis, when the effects of the inhibitor become apparent.

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19 May 1955

Evidence That Serotonin Has a Role in Brain Function

The finding of serotonin (5-hydroxytryptamine) in brain (*1*, *2*) has aroused speculation that it may have a role in brain function (*3*), perhaps as a neurohumoral agent (*4*). Studies from our laboratory that support this view have shown that lysergic acid diethylamide (LSD), a hallucinogenic agent, suppresses an action of serotonin on the central nervous system (*5*), while reserpine, a drug used in treatment of mental disorders, liberates serotonin from body depots, including intestines (*6*) and platelets (*7*).

The development of a specific fluorometric assay for serotonin in brain (*2*) has now made it possible to test our hypothesis that reserpine action may be mediated through the liberation of serotonin in brain. The serotonin content of brain, normally about 0.55 μg/g, declined rapidly after the intravenous injection of 5 mg/kg of reserpine. Within 30 minutes the total brain serotonin declined by about 75 percent and within 4 hours it declined by about 90 percent. The low level persisted for about 24 hours and then increased slowly, attaining the normal value after about 7 days. The brain is particularly sensitive to the serotonin-releasing properties of reserpine—doses as low as 0.1 mg/kg appreciably lowered the serotonin content.

Reserpine measured fluorometrically was no longer detectable in brain 12 hours after administration (*8*), whereas sedative effects and changes in brain serotonin persisted longer than 48 hours. The sedative effects thus seem to be related to the change in brain serotonin rather than to the concentration of reserpine. This may be interpreted as further evidence that reserpine acts through liberation of serotonin. Throughout the period of low serotonin content in brain, 5-hydroxyindoleacetic acid, the metabolic product of serotonin, appeared in urine in appreciable amount. Presumably, therefore, serotonin was still being formed in the body but was not accumulating in brain tissue. Thus it seems that reserpine causes an alteration in the serotonin-binding capacity of brain cells that persists long after reserpine can no longer be detected.

Our present concept, on the basis of the available facts, is as follows: serotonin in brain is normally present mainly in a bound form, thus being protected from the highly active enzyme, monoamine oxidase (*9*). After reserpine administration, brain cells lose, in part, their capacity to retain serotonin. As a result, serotonin is liberated and metabolized by the action of monoamine oxidase. Although reserpine rapidly disappears from the brain, the effect on the capacity of cells to retain serotonin persists. Since serotonin is still being formed during this period, much of it is presumably present in a free or physiologically active form. This free form of serotonin is considered as the mediator of the prolonged reserpine action. Since free serotonin is rapidly metabolized, the total serotonin remains at a low level.

The data described in this communication are in accord with the view that serotonin has an important role in brain function, possibly as a neurohumoral agent.

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4 October 1955

Systematic Effect of C^{14}-Labeling on Ion-Exchange Chromatography of Amino Acids

In the course of studies on amino acid metabolism in mammalian cells in tissue culture (*1*), protein hydrolysates from cells fed C^{14}-labeled glucose or glutamine were chromatographed on an ion exchange column. It was observed that the peaks of radioactivity in the effluent did not precisely coincide with amino acid peaks located by the ninhydrin color reaction, but in every case followed them closely. The two curves were identically shaped, and activity did not occur elsewhere in the effluent. It seemed likely that the heterogeneity was the result of the partial resolution of labeled from unlabeled amino acid. This was shown to be the case by chromatography of known C^{14}-labeled amino acids. Some preliminary observations concerning the nature of the effect are reported in this paper.

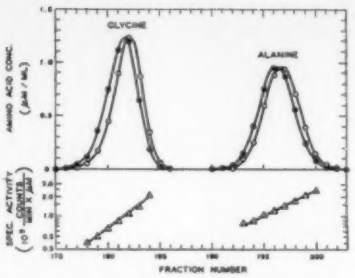

Fig. 1. Portion of the effluent curve from the chromatography of C^{14}-labeled amino acids on a 100- by 0.9-cm column of Dowex 50: ●, amino acid concentration as determined by ninhydrin; ○, amino acid concentration as determined by C^{14} count assuming 100 percent recovery; and △, calculated specific activities.

The ion-exchange separation used was a modification of the methods of Moore and Stein (*2*, *3*). A 100- by 0.9 cm column of Dowex 50 (*4*), operated at 50°C and 6 ml/hr throughout the run, was employed. Elution was started from a reservoir containing 250 ml of a 0.37*M* citrate buffer (0.25*N* in sodium citrate) of *p*H 3.10. A continuous *p*H gradient was produced by the addition of 0.25*N* sodium hydroxide to the buffer to give a ratio of flow rates into and out of the reservoir of 1 to 5.7. After about 170 ml of effluent had been collected, the ratio of flow rates was changed to 1 to 1. The degree of resolution provided was significantly greater than it was in the original Moore and Stein procedure (*2*) with a 100 cm column and in some respects was equal to that of their newer method (*3*) employing a 150 cm column.

Approximately 4 μmoles each of L-aspartic, L-threonine, L-serine, L-proline, glycine, L-alanine, and L-valine (*5*), all uniformly labeled with C^{14} at a level of about 0.1 μc/μmole, were chromatographed. One-milliliter fractions were collected and 3 ml of water were added to each. One milliliter was taken for determination of amino acid concentration with ninhydrin (*6*). Carbon-14 was determined on a 0.5-ml portion of the remainder after diluting 1 to 50, except at the leading and trailing edges of the peaks, where 0.5 ml of undiluted sample

was taken. The samples were dried in 1-cm copper planchets and counted in a gas flow counter. Corrections for self-absorption were not necessary on the diluted samples. On the others, a known amount of the labeled amino acid was added to occasional samples; these were then dried and counted, and the absorption factor was calculated. This value did not vary significantly within any one peak. That part of the effluent curve showing glycine and alanine is reproduced in Fig. 1, together with the calculated specific activities for the individual fractions. Qualitatively similar results were obtained with all the amino acids studied.

It is apparent that the presence of C^{14} in an amino acid molecule resulted in slower movement on the column. Consequently, there was a progressive increase in the specific activity of the fractions within a peak. In large part, the observed differences involved singly labeled molecules, for the amino acids were uniformly labeled only in a statistical sense, and the level of radioactivity in the source material used for their biosynthesis corresponded to a C^{14} to C^{12} ratio of approximately 1 to 10 (*5*). It follows that in the case of glycine, for example, approximately 18 percent of the total counts would have been contributed by doubly labeled compound.

If it is assumed that each pair of curves can be represented by the same distribution curve with different means, an equation relating specific activity to fraction number can be derived from the ratio of the two distribution curves (*7*). For a normal distribution, the logarithm of the specific activity proves to be directly proportional to the fraction number in the region where the peaks overlap. The slope constant describing this linear relationship is a measure of the degree of resolution of the labeled and unlabeled compounds. The slopes for the seven known amino acids here studied are given in Table 1. Also included are the slopes obtained from the chromatography of a hydrolysate of total protein from cells fed uniformly labeled glucose. It is apparent from Table 1 that there was an extremely close relationship between the ratio of C^{14} to total C in a labeled molecule and the degree of resolution. Using the slopes listed in Table 1 (the average when two figures were available) the correlation coefficient was in fact 0.96. The correlation coefficient between slope and molecular weight was −0.74. This suggests that the effect of a C^{14} atom on chromatographic behavior may depend on its position in the molecule, rather than solely on its mass. The larger the number of carbon atoms, the smaller would be the chance that a single C^{14} atom would appear in one of the more effective positions. This working hypothesis is supported by the observation that the specific activity slopes of glutamic acid and proline derived from glutamine-2-C^{14} were more than twice those observed for the randomly labeled compound.

Table 1. Slope of curve relating the logarithm of the specific activity of randomly labeled amino acids to fraction number. The slopes are given in arbitrary units; A, known amino acid mixture; B, protein hydrolysate of cells fed labeled glucose.

Amino acid	Ratio* of C^{14} to total C	Slope	
		A	B
Glycine	1/2	100	108
Serine	1/3	62	51
Alanine	1/3	59	66
Aspartic acid	1/4	57	54
Threonine	1/4	32	
Valine	1/5	24	
Proline	1/5	21	
Glutamic acid	1/5		16

* Ratio per labeled molecule, assuming a single label.

Isotope effects have been noted in a number of biological and chemical systems (*8*) as well as in behavior on ion-exchange chromatography (*9*). A slight concentration of natural isotopes by ion exchange was first reported for Li^6 and Li^7, K^{39} and K^{41}, and N^{14} and N^{15} by Taylor and Urey (*10*) and by Brewer (*11*), who used 35-ft and 100-ft columns of a natural zeolite. Recently, a 780-fold concentration of N^{15}-labeled ammonia to 74 mole percent N^{15} has been effected by repeated cycling through 5-ft columns of Dowex 50 for a total of 600 ft (*12*). Tritrium-labeled organic acids have shown a similar isotope effect on partition chromatograms (*13*). In contrast, the same technique failed to change the isotope ratio of C^{14}-labeled formic acid significantly. The difference in chromatographic behavior between the labeled and unlabeled amino acids in the present experiments was small; but it is possible that with much larger columns and repeated cycling, an isotopic enrichment could be developed similar to that accomplished for $N^{15}H_3$ (*12*).

Coincidence of radioactivity and ninhydrin color has been widely used as a criterion of identity in the study of labeled amino acids and related compounds. This seems to be valid for paper chromatography, but it is not valid for the newer methods of ion exchange chromatography with their extremely high resolving power. However, a straight line relationship, with the correct slope, between the logarithm of the specific activity and the fraction number would serve as a criterion of homogeneity. There is a large possible error if a single fraction, rather than the entire peak, is used for the determination of specific activity.

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$$\ln S = \left(\frac{m_1 - m_2}{\sigma^2}\right) x + \frac{m_2^2 - m_1^2}{2\sigma^2}$$

where S is the specific activity, m_1 is the mean of the activity curve, m_2 is the mean of the ninhydrin color curve, σ is the standard deviation, and x is the fraction number.
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28 September 1955

Thallium Acetate in the Diagnosis of Chronic Respiratory Disease of Chickens

Thallium acetate (TA) was first recommended in 1947 as a bacteriostatic agent in the isolation of pleuropneumonialike organisms (PPLO) in liquid medium and on plate cultures (*1*). In primary isolations where contamination was usual, TA in proper concentration inhibited ordinary bacteria and allowed PPLO to grow in pure culture. In another study of PPLO of human origin (*2*), TA used as a bacterial inhibitor in liquid and solid media did not produce "L" forms from bacteria, possessed a wide bacterial spectrum, inhibited both gram-positive and gram-negative organisms, and had a selective action independent of the total protein content of the culture medium.

Chronic respiratory disease (CRD) of chickens, caused by a PPLO (*3*), is diagnosed by isolation of the agent in em-

bryonating chicken eggs or on artificial medium. In a study of the etiology and pathology of the CRD complex of chickens (*4*), the agent was isolated by the following procedure. Tracheal scrapings from a chicken were added to broth and penicillin was added to control bacterial contamination. Penicillin does not affect PPLO (*5*) but does suppress growth of certain contaminating bacteria. After this mixture had been incubated, a portion was injected into the yolk sac of embryonating chicken eggs. The presence of the CRD agent was revealed by specific respiratory lesions in the embryo.

In a later investigation of field cases (*6*), contaminated suspensions were retested. However, in addition to penicillin, 0.15 ml of aqueous 5-percent Seitz-filtered TA solution (*7*) was added to each milliliter of the broth suspension containing the tracheal scrapings. Treated suspensions were subjected to several serial embryo passages to determine whether the CRD agent was present. The harvested allantoic fluid from the serial passages was bacteriologically cultured, and TA was not added after the first embryo passage. Characteristic respiratory lesions in the embryo were regarded as positive evidence that the scrapings contained the CRD agent.

Use of TA made it possible to identify CRD in seven of ten cases in which the tracheal suspensions were heavily contaminated with bacteria. Unfortunately, TA may prove toxic for embryos. Some embryos inoculated with the suspension containing TA died early. Others exhibited marked stunting, underdevelopment of the mandible, and micromelia. When TA alone was inoculated into yolk sacs of 7-day-old embryos, the same teratologic syndrome affected most embryos (Fig. 1).

A similar syndrome has followed injection of insulin, boric acid, or pilocarpine hydrochloride into developing 4-day-old chicken embryos via the yolk sac. The best method to reduce or prevent this teratologic effect was to inject nicotinamide (NA) simultaneously. The protective effect of NA suggested that the skeletal defects were caused by a disturbance of carbohydrate utilization (*8*).

Another series of experiments was therefore carried out to determine whether NA would neutralize the effect of TA. The following mixtures of a 5-percent solution of NA and a 5-percent solution of TA were tested: (i) 0.5 ml TA and 0.5 ml NA; (ii) 0.3 TA and 2 ml NA; and (iii) 0.15 ml TA and 2 ml NA. After 10-min incubation, the material was inoculated into yolk sacs of 7-day-old embryos. NA did not neutralize the teratogenicity of TA. The concentrations of NA employed may not have been adequate, the embryos may have been too old, or the syndrome, although similar to the one described by Landauer (*8*), may have been caused by another type of disturbance in the developing embryo.

Fig. 1. Embryo on left: 14 days postinoculation. Yolk sac inoculated at 7 days with 0.2 ml of a dilute solution of thallium acetate (0.15 ml of a 5-percent solution in 1 ml of water). Stunting, micromelia, and shortened mandible. Embryo on right: Uninoculated control (same age as inoculated embryo). [Photo by C. Brandt]

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11 July 1955

Isotopic Composition of Common Lead from Southern Africa

The apparent extreme age of some pre-Cambrian rocks in southern Africa has been further demonstrated by recent publication (*1*) of the isotopic composition of common lead minerals from this region, showing ages in excess of 2×10^9 years. This report (*2*) supplements the earlier work with isotopic analyses of 16 samples from pre-Cambrian rocks in southern Africa (Table 1). The experimental procedure used is described elsewhere (*3*).

The merits and limitations of the so-called "common lead age" method have been discussed by several writers (*4*). If the broad assumptions necessary for the method are granted, equations such as the following may be used for determining the time of mineralization, t_m (in billions of years), measured from the present:

$$x_m = 18.87 - 11.54\ (e^{.154\ t_m} - 1) \quad (1)$$
$$y_m = 15.77 - 0.0836\ (e^{.972\ t_m} - 1) \quad (2)$$
$$z_m = 39.15 - 42.74\ (e^{.0499\ t_m} - 1) \quad (3)$$

x_m, y_m, and z_m are the ratios of Pb^{206}, Pb^{207}, and Pb^{208} to Pb^{204}, respectively, measured for each sample. The particular values of the lead constants shown were determined from a number of dated galenas at this laboratory (*3*). The three isotopic ages obtained from Eqs. 1–3 for each mineral are averaged together to give the age shown in Table 1. The error associated with each sample age is a measure of the spread in values of the three isotopic ages, compounded with a small uncertainty in the isotopic composition.

With the exception of the Elba (No. 5) galena, all the samples from the basement complex of Southern Rhodesia show great age, possibly indicating a single major period of mineralization in the range of 2.2 to 2.5×10^9 years ago. The time of the Elba mineralization is uncertain because of a considerable spread in the three isotopic ages (0.5 to 1.6×10^9 years). Nevertheless, the Elba sample probably represents a different and later period of mineralization.

Three samples (Nos. 8, 11, and 14) from South Africa give apparent ages that are considerably younger than their pre-Cambrian environment. The geologic environment for these three minerals makes a real age less than about 800 million years very unlikely. The isotopic and geologic data therefore suggest that these three leads may have been originally deposited with an anomalously large amount of radiogenic lead.

The Keimos (No. 15) galena contains excessive amounts of radiogenic lead, exhibiting an anomalous composition very similar to that characteristic of lead deposits in the Mississippi Valley (*3*, *5*). The composition of the Witwatersrand (No. 16) sample shows contamination with uranium lead and is similar to that reported by the Toronto group (*1*). No reliable age assignments can be made for either of these leads. In any event, the Keimos anomaly merits further investigation in view of an apparently normal geologic environment and derivation.

Table 1. Lead isotopic composition of galena specimens from South African pre-Cambrian rocks

Locality	Geologic occurrence	Lead isotopic composition 206/204	207/204	208/204	Apparent common lead age (10^9 yr)
Southern Rhodesia					
1) S. T. Mine near Bindura*	Veins of galena in arkosic metasediments	14.16	15.06	34.22	2.2 ± 0.1
2) Kingsley Hoard Mine, Bindura, Mazoe Dist.	Replacement ore in arkosic and semipelitic metasediments	13.99	14.89	33.97	2.3 ± 0.2
3) Hardy (gold) Mine, Darwin Dist.	Gold vein in basement complex	14.02	14.74	33.85	2.4 ± 0.2
4) St. Ives Mine, near Turli, Bubi Dist.	Quartz vein in volcanic greenstone country	13.74	14.57	33.69	2.5 ± 0.2
5) Elba (gold) Mine, Wankie Dist.	Gold vein in basement complex	16.79	15.46	37.97	1.0 (?)
6) Cobra (gold) Mine, Gwanda	In greenstone country near granite contact	14.00	14.89	34.05	2.3 ± 0.2
7) C. S. C. Mine, Wedza, Marandellas Dist.	W, Pb deposit in marbles, pelitic metasediments, and Fe quartzites	14.15	15.17	33.86	2.3 ± 0.2
Southwest Africa					
8) Ombonna 89, Otjiwarongo Dist.†	Vein in reddish phase of Salem (?) granite	18.71	15.52	38.95	< 0.8
Union of South Africa					
9) Leeuwenkoof 97, Pretoria Dist.	Replaces dolomite of Transvaal system	14.92	15.06	34.21	2.1 ± 0.2
10) Uitloop 291, Potgietersrust Dist.	Quartz vein in granite older than Bushveld igneous complex	14.97	15.07	34.71	2.0 ± 0.2
11) Stavoren (tin) Mine, Potgietersrust Dist.	Cassiterite pipes in granophyres of Bushveld igneous complex	18.14	15.76	38.47	< 0.8
12) Appelfontein 71, Zoutpansberg Dist.	Quartz vein in "Old Granite"	15.94	15.40	36.76	1.4 ± 0.3
13) Rosetta Mine, Barberton Dist.	Quartz vein in Jamestown complex intrusive into Figtree schists	12.58	14.11	32.77	2.9 ± 0.1
14) Dyasonsklip, Gordonia, about 15 mi SW of Uppington	Vein in Namaqualand granite-gneiss	18.09	15.57	37.80	< 0.8
15) Keimos, Orange River Valley, Cape Province‡	Associated with either Namaqualand pegmatites or older Archean intrusive rocks that are cut by the pegmatites	20.41	15.66	41.49	Anomalous
16) East Geduld (gold) Mine, Witwatersrand		18.03	15.98	34.48	Anomalous, probably pre-Cambrian

* Samples 1–7 and their descriptions were supplied by R. M. Tyndale-Biscoe, acting director, and A. M. Macgregor of the Geological Survey of Southern Rhodesia.
† Samples 8–14 and 16 and their descriptions were provided by L. T. Nel, director, and B. Wasserstein of the Geological Survey of South Africa. Survey museum numbers corresponding to table numbers are as follows: No. 8, 4523a; No. 9, 4415; No. 10, 4480; No. 11, 3487; No. 13, 758; and No. 14, 4512. Samples 12 and 16 are from Wasserstein's personal collection.
‡ Sample and description supplied by A. Poldervaart, geology department staff, Columbia University, New York, N.Y.

The Rosetta galena (No. 13) was identical to that submitted by Nel to the Toronto group, and the isotopic composition here reported agrees well with the earlier measurement (*1*). Our age of 2.9×10^9 years is essentially identical to the 2860×10^6 years reported in the Canadian work (*1*).

A more complete history of this important area may be reconstructed with the aid of additional isotopic analyses of common leads and of uranium-bearing minerals. The tentative nature of the age determinations in this paper must be emphasized in view of the uncertainties in the values of the constants used in the lead growth Eqs. 1–3 and of possible inhomogeneities in the Pb/(U + Th) ratios in the crust.

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20 July 1955

Tetrazolium-Reduction Test for Milk

Tetrazolium salts are redox indicators; their oxidized state forms colorless or pale yellow solutions in water. When reduced, they become insoluble in water and form highly colored crystals of formazan. The formazan of triphenyltetrazolium chloride (TTC) is red, that of neotetrazolium chloride (NT) is purple, and that of blue tetrazolium (BT) is dark blue.

In 1951 Schönberg (*1*) introduced the use of TTC in the indirect determination of the bacterial content and the keeping quality of milk. He concluded that the TTC-reduction test is best suited as a rapid screening test for milk samples with a high bacterial content. Later (*2*) he pointed out that the reliability of the results obtained with TTC in diffuse daylight of changing intensity may be questioned because light has a

marked accelerating effect on the reduction of TTC.

This paper (*3*) reports the applicability of TTC, NT, and BT for the testing of milk under different conditions. The tetrazolium tests were performed simultaneously with a conventional methylene blue test in unstoppered glass tubes. The final concentrations of the tetrazolium salts were 10^{-3} and 10^{-4} (9 ml of milk and 1 ml of 1.1-percent weight per volume stock solutions of TTC, NT, and BT).

The incubation temperatures were 37°C and room temperature was 19° to 21°C. At room temperature, the tests were performed simultaneously in darkness and under the influence of scattered light of blue sky or of direct sunlight. The bacterial contents of the milk samples were estimated customarily by counting the number of the colonies on agar and gelatin plates.

Tetrazolium salts in a concentration of 10^{-3} were inhibitory to the milk bacteria since the reduction times were definitely prolonged. The concentration 10^{-4} was, therefore, more suitable for the testing of milk. The results obtained using a 10^{-4} concentration of the tetrazolium salts and a dark thermostat of 37°C are summarized in Table 1.

The table shows that the reduction of the tetrazolium salts in the milks with 4×10^6 bacteria per milliliter or less becomes visible earlier than the reduction of methylene blue. In good milks with long reduction times the colors of formazans are first seen at the bottoms of the tubes because of the sedimentation of bacterial clumps. In milks highly contaminated with bacteria, TTC and NT seem to be equal with methylene blue in the rapidity of reduction, while the use of BT is hampered by its slower reduction.

As is known, room temperature (19° to 21°C) is inapplicable to the methylene blue test because reduction occurs in a reasonable time only with milks highly contaminated with bacteria. In contrast, it is a definite advantage of tetrazolium salts that they may be employed at room temperature when milk samples with high bacterial contents are screened under field conditions. The formation of formazan is relatively little delayed in such milks by room temperature.

When the effect of light on the reduction of the tetrazolium salts was studied, it was found that TTC was the most photosensitive. Even plain water solutions of TTC became red under the influence of light, whereas the water solutions of NT and BT were stable. In milk the reduction of tetrazolium salts is accelerated by the light more than the reduction of methylene blue. The reduction in light was partly nonenzymatic, for boiled samples of milk also exhibited formazan formation on the side of the tube directed toward the light source. The higher the concentration of tetrazolium salts in the milk, the more photosensitive the reaction and the poorer the correlation between the reduction time and the bacterial content. We can agree with Schönberg (*2*) that the tetrazolium-reduction test performed in a diffuse daylight of unknown intensity using TTC in a final concentration of 10^{-3} yields inconsistent results concerning the bacterial content. Therefore, the tests should be conducted in complete darkness.

Thirty-eight percent formaldehyde up to a final concentration of 5×10^{-3} accelerated the reduction of methylene blue, but this concentration was definitely inhibitory to the formation of the formazans. Aldehydeoxidase of Schardinger seems, therefore, to play a smaller role in the reduction of tetrazolium salts than it does in the reduction of methylene blue. Salicylic acid was found to inhibit equally the reduction of the tetrazolium salts and that of methylene blue.

When a continuous stream of air was conducted simultaneously into identical tests with methylene blue and with the tetrazolium salts, it was found that methylene blue was not completely reduced to the leuco form, whereas the reduction of the tetrazolium salts was only slightly delayed. The stability of formazans against oxygen seems to be a great advantage of the tetrazolium salts over methylene blue, which is readily reoxidized by the atmospheric oxygen (*4*). Moreover, the number of bacteria that are capable of reducing tetrazolium salts can be estimated by microscope since the intensely colored microcrystals of formazan are intracellularly deposited in the bacteria.

Our attempts to develop a quantitative colorimetric method by extracting the formazans from milk with lipid solvents (*5*) were unsuccessful. Quantitative yields were not recovered with the use of ether, chloroform, benzene, toluene, xylene, methanol, ethanol, propanol, butanol, amyl alcohol, and their combinations with glacial acetic acid.

Table 1. Reduction times of the tetrazolium salts and methylene blue (MB) as influenced by the bacterial content of milk samples

Bacteria (No./ml)	Reduction time (min)			
	TTC	NT	BT	MB
$< 10^6$	> 420	> 420	> 420	> 660
10^6 to 5×10^6	420 to 270	420 to 270	420 to 270	660 to 360
5×10^6 to 4×10^6	270 to 90	270 to 90	270 to 90	360 to 120
4×10^6 to 20×10^6	90 to 25	90 to 15	90 to 60	120 to 20
$> 20 \times 10^6$	< 25	< 15	< 60	< 20

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5 July 1955

Fluorescence Characteristics of 5-Hydroxytryptamine (Serotonin)

Although no definite function has been ascertained for 5-hydroxytryptamine (5-HT), it is already evident from the reports of numerous investigators that it may be an important physiological agent. The most interesting development is the possible connection between 5-HT and brain function as first suggested by Gaddum (*1*), and indicated by recent studies of Shore, Silver, and Brodie (*2*).

To obtain more information about this compound, it is necessary to develop methods for its analysis in tissue extracts. A number of bioassays for 5-HT have been reported (*3, 4*) and these have contributed important information concerning the distribution of this compound. However, standard chemical procedures are not sufficiently sensitive to detect the small amounts that are present in tissues such as brain and blood.

In a previous communication, it was reported that 5-HT in dilute acid or at neutral *p*H fluoresces at 330 mμ when activated at 295 mμ (*5*). The fluorescence in the ultraviolet was detected with a specially designed spectrophotofluorometer. The sensitivity of the fluorescence in the ultraviolet is such that less than 0.1 μg can be readily measured. However, extracts of certain tissues such as brain contain other materials that fluoresce near 330 mμ and therefore make analysis difficult.

It has now been found that in stronger acid (3*N* HCl), 5-HT and other 5-hydroxyindoles fluoresce at 550 mμ and

that this fluorescence is also maximally activated at 295 mμ. This shift of fluorescence from the ultraviolet to the visible, with increasing acidity, is completely reversible and is not accompanied by a noticeable change in the absorption spectrum. No corresponding shift in fluorescence is observed with tryptamine, which is activated at 275 mμ and fluoresces at 360 mμ. In fact, tryptamine and tryptophan fluorescence disappear in 3*N* HCl. Obviously, this shift in fluorescence of 5-HT in strong acid must be related to the phenolic group.

Although the significance of this phenomenon is not understood, it can be useful as a method for assaying 5-HT. The visible fluorescence is almost as intense as that at 330 mμ and offers as an additional advantage the possibility of using available fluorescence measuring devices. Where instruments are available for measuring both peaks of fluorescence, the ability to shift the fluorescence from 330 mμ to 550 mμ and back offers additional specificity, since other indoles such as tryptophan do not do this. The factor of specificity is of great importance in measurements on tissue extracts.

A specific method for the determination of 5-HT in brain, based on measurement of 550 mμ fluorescence, has already been developed (*6*).

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11 July 1955

Two Carbohydrases Occurring in Insect-Produced Honeydew

By fractionally precipitating a concentrated aqueous solution of honeydew with ethanol, we have obtained fractions free of sugars that possess definite carbohydrase activities. We have obtained these enzymes from honeydews of the cottony-cushion scale, *Icerya purchasi* Mask. and the soft scale, *Coccus hesperidum* L. These honeydews are different types; the former have melezitose [α-D-G_p-(1→2)β-D-Fru_f-(3←1)-α-D-G_p] and the latter have gluco-sucrose [α-D-G_p-(1→4)-α-D-G_p-(1→2)β-D-Fru_f] as their principal trisaccharides.

Of various carbohydrates containing α- and β-glucosidic, β-fructosidic, and α-galactosidic linkages, only free sucrose would serve as a substrate. In both cases, the enzymes react with sucrose to produce a trisaccharide and monosaccharides. Cottony-cushion enzyme produces melezitose, glucose, and fructose; soft-scale enzyme produces gluco-sucrose, glucose, and fructose. In both cases, the appearance of free glucose must require isomerase activity, for more than half of the monosaccharides produced is glucose. Whether this is a function of a separate enzyme or not is not apparent at this time; suffice it to say that there is no reaction discernible when glucose and fructose are used as a substrate. Both enzymes have little or no hydrolytic activity on either of the trisaccharides they produce even though they both appear to act as α-glucosylases that require hydrolytic action as the initiating step for their synthesis reactions.

The evidence at hand indicates that these enzymes are produced by the insects rather than that they are present in the sap of the host plant. Transcarbohydrases have been reported by Giri *et al.* [*Science* **121**, 898 (1955)] from rat liver but this is, to our knowledge, the first instance of this type of enzyme from insects.

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11 July 1955

Graphic Determination of Mean Values

In a recent communication, G. W. Hervey (*1*) commented on a graphic method for determining the mean value of three ordinates presented in a paper on moving averages (*2*). Earlier references have been found (*3*); an essentially equivalent procedure, the location of the centroid of a triangle, dates back to the writings of Archimedes (*4*).

However, the extension of this type of technique to apply to any number of points was described only recently (*5*), and further investigation (*6*) of the properties of centroids has led to other graphic methods. The center of gravity of the points charted on a scatter diagram represents simultaneously the mean values of both the *x* and *y* variables. If the number of points can be factored into powers of 2 and 3 only, the graphic location of the centroid is straightforward and rapid. For example, with 24 ($2 \times 2 \times 2 \times 3$) points, joining neighboring points in pairs and marking the midpoints of the 12 segments so obtained will lead to 12 points, each representing two of the original 24. Repeating this process will reduce the number of points from 12 to 6, and then from 6 to 3. Finally, the centroid of these 3 points may be found by joining them to form a triangle, marking the midpoints of the sides, and drawing the medians from each angle to the midpoint of the opposite side. The common intersection point of these three medians represents the centroid of the original 24 points. Standard deviations (*7*) as well as regression lines and correlation coefficients (*8*) may then be calculated by various geometrical methods related to "crab addition" (*9*). Adaptations of the technique to cases in which the number of points contains factors other than 2 and 3 are being completed.

A study of centroids of unequally weighted points has resulted in the development of a number of convenient graphic procedures for handling numerical data. These include graphic methods for determining mean rate of change (*10*), fitting of straight lines according to the criterion of least squares, approximate integration by Simpson's rule, estimation of moments of area, and calculation of mean values and standard deviations for frequency distribution diagrams. Papers describing these techniques are in preparation.

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7 July 1955

Book Reviews

Estudos Sôbre os Vírus Coxsackie. Paulo de Góes. Universidade do Brasil, Rio de Janeiro, 1954. 271 pp. Illus.

Brazilian workers were among the first to study the Coxsackie viruses, and the work of Travassos, de Góes, and their colleagues has now been fully described by de Góes in the present monograph, which also includes an extensive review of earlier publications.

The Brazilian work establishes the presence in Brazil of many of the well-known types of Coxsackie viruses under circumstances much like those elsewhere in the world. The rate of isolation was quite high, and this suggests that perhaps infection is somewhat more common in Brazil than in North America, but this question could presumably be better answered by serologic surveys of the kind John Paul has used so successfully.

De Góes adds to our knowledge of the morbid anatomy of experimental infections and confirms the usefulness of histologic criteria in grouping new strains. Having a special interest in hemagglutination tests, it is not surprising that he undertook a thorough search for blood cells that would agglutinate in the pressure of Coxsackie viruses. Agglutination was not demonstrated, but it was learned that the virus is adsorbed on mouse erythrocytes.

Most of the viruses isolated belonged in group A. The most consistent isolations were from cases of herpangina, an experience others have shared. Reading between the lines, one might suspect that Bornholm disease was uncommon in Brazil during the years the study was underway. Although a few group-B strains were isolated, they occurred infrequently and sporadically. It may well be that Bornholm disease is not as common in Brazil as it is in certain other countries and that the Brazilian experience is another clue to a changing pattern of group-B infections similar to what has occurred in the case of poliomyelitis. Large epidemics of Bornholm disease are of relatively recent occurrence. They first appeared in countries in which poliomyelitis also first became epidemic. Other countries have since experienced first epidemics, and prevalence seems to have increased wherever that has happened.

The Coxsackie viruses gave us our first inkling of the variety and ubiquitousness of human enteric viruses, an impression that the discovery of the "orphan" viruses has confirmed. The orderly study of these agents is only now being organized. It may well become as interesting and as instructive a chapter of microbiology as was the study of the enteric bacteria. Such studies can be greatly benefited by international association, and the interest of de Góes and his colleagues gives promise of that kind of cooperation.

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Analysis of Insecticides and Acaricides. A treatise on sampling, isolation, and determination, including residue methods. Francis A. Gunther and Roger C. Blinn. Interscience, New York–London, 1955. xi + 696 pp. Illus. $14.

This volume, the only one of its kind in its field, was written primarily for research workers in the field of insecticides. The book consists of three sections, divided into 15 chapters.

Of particular interest is Section 1, "Problems in securing quantitative residue data," consisting of nine chapters. The section commences with a discussion, "Persistence of residues as an analytical problem," and takes the reader through presampling and sampling considerations, sample processing, cleanup treatments, analysis, interpretation of data, analytic bookkeeping, and health hazards. Parts of the material presented are available piecemeal in other publications, but much of it is unpublished information gained by the authors in their laboratories. No other publication brings all parts of this problem together in their proper relationship to one another. This section, alone, makes the book unique in its field.

Section 2 discusses the problem of analyzing technical grade materials and formulations and, very concisely, considers sampling, sample processing, cleanup, and analysis.

Section 3 consists of five chapters discussing sampling, measuring, processing, cleanup, and analytic procedures. The steps preceding actual analysis are discussed in detail and their importance is properly emphasized. Many excellent papers have been published on analytic methods for insecticide deposits and residues, but virtually no information has been given on sampling and processing prior to the analysis. It is emphasized that an analytic method is only as good as the steps that precede it.

The last chapter gives detailed analytic procedures for 90 insecticides and acaricides. Methods are given for both composition and residue analysis, when they are available. When more than one acceptable method is known, all are discussed. As indicated by the authors, most of the methods for residues have been used in their laboratories; many modifications and short cuts developed by them are included. The directions for analytic methods are very detailed and are easily followed. Many workers will differ with the authors on some details in the procedures because of personal preferences, which are always a factor in any analytic method.

Two appendixes, giving detailed ultraviolet and infrared spectra for a number of insecticides and acaricides and some possible degradation products, conclude the book.

The volume is a masterful presentation of the subject and should prove invaluable to anyone concerned with the analysis of insecticides and acaricides. Some of the procedures in sampling, sample preparation, or analysis may be questioned, as may the selection of some of the methods of analysis. As brought out by the authors in the preface, one of the more important reasons for writing the book was to stimulate further research along these lines.

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Optical Properties of Thin Solid Films. O. S. Heavens. Academic Press, New York; Butterworths, London, 1955. vii + 261 pp. Illus. $6.

Heavens' book presents a package of a science and technical art that, during and since the war, has grown attractive to many workers. This attractiveness stems from unsolved scientific questions and practical applications of the art. Such a book can never be a complete presentation; its excellence and usefulness always reflect the writer's judgments on content, as well as his scientific carefulness and literary competence. This book omits mention of some of the early

and significant work; therefore it is to be taken as Heavens' own Olympus of thin films. But the book is both a satisfying and provocative purchase.

Heavens' book will be satisfying to the reader because a new science can be contacted in or through his book. It will be satisfying because of the uniformity and clarity of style and the coherence of the author's re-presentation and epitome of the original literature.

The book will be provocative to the original mind, as are all such competent surveys written by authors who are themselves intimate with their subjects. It is provocative in the sense that hardly a page fails to evoke an idea for an experiment or investigation that is worth while or needs to be done. We may expect Heavens' work to be very stimulating to and important for the growth of the art he treats.

I not only recommend this book to those already interested in thin films, but also to those who have a problem-solving competence that is currently unemployed. For the theoreticians, the optical theory presented is certainly more complex and less useful than it will be in the future; and for experimentalists, the techniques described (thermal evaporation of films) have great power for study of the solid state. For example, to appreciate the opportunities, we only need to imagine the study of thin films developed to the point where a similar work on their mechanical properties could be prepared; but first the experiments need to be made and theory needs to be formulated. The attraction of such optical or mechanical research lies in the relatively modest equipments required for it.

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Beta- and Gamma-Ray Spectroscopy. Kai Siegbahn, Ed. Interscience, New York; North-Holland, Amsterdam, 1955. xiv + 959 pp. Illus. $20.

The object of this volume, as stated by the editor, who is a well-known expert on beta- and gamma-ray spectroscopy, is to facilitate the entry of the newcomer into this field of nuclear research. Actually, the book offers considerably more than this statement implies. The experimentalist who is actively engaged in nuclear research will find this volume, in most parts at least, an extremely useful and well-documented reference and handbook.

The large amount of material is distributed in 26 chapters, each of which was prepared by one or more specialists in the particular field.

The first two chapters give a good survey of the interaction of electrons and gamma rays with matter. A comprehensive and up-to-date discussion of theory and design of beta-ray spectrometers follows; high-resolution spectroscopy is included. Gamma-ray spectroscopy by crystal diffraction is discussed by the most competent worker in this field. An excellent survey of the scintillation method, full of useful information and practical details, is presented in the next chapter. Particular detection methods, including proportional-counter spectrometry and special methods in gamma-ray spectroscopy, are discussed in the sixth chapter.

Unfortunately, the discussion of the important coincidence method in the next chapter, although it is informative, is somewhat out-of-date, for it is based mostly on the use of Geiger-Müller counters; very little is said about the use of scintillation detectors in coincidence arrangements. Special problems of beta-spectrometer measurements, including details of source and window techniques, are treated in the next chapter, which is followed by three clearly written articles on (i) theory of allowed beta decay, (ii) theory of forbidden beta decay, and (iii) experiments on the shapes of beta spectra with emphasis on the choice of the interaction of beta decay. Intimately related to the problems of beta decay are the neutrino recoil experiments that are competently discussed in the next chapter. The theories of multipole radiation and internal conversion are then presented in the 13th and 14th chapters, respectively.

After two excellent chapters that describe the present status of the interpretation of experimental nuclear data on the basis of the shell model and the unified model, the measurement of short lifetimes of nuclear excited states by the delayed coincidence method, on the one hand, and by the method of resonant scattering of gamma radiation, on the other hand, is described. Three well-organized articles follow. They form the 19th chapter, which is devoted to theory and experiments on the angular distribution of nuclear radiation. In the chapter that follows this rather theoretical discussion, some internal effects involved in nuclear decay processes, such as the emission of Auger electrons, the formation of internal pairs, and internal *bremsstrahlung* are treated.

In the remaining six chapters, particular problems that are more or less related to beta- and gamma-ray spectroscopy are considered—including ordinary and double Compton effect, double beta decay, annihilation of positrons in various substances and the formation of positronium, some illustrative disintegration studies, gamma radiation emitted during charged particle reactions, neutron-capture gamma rays, and the measurement of disintegration rates. The appendix of the book deserves mention because it gives extremely valuable tables containing numerical data useful for the evaluation and interpretation of experimental results.

As a whole, the book is well edited. In the discussion of such a great variety of problems by a number of different authors, it is inevitable that some aspects are neglected, on the one hand, and that the same subject is considered by several of the contributors, on the other hand. Some overlapping does occur and some omissions and minor errors were noticed, but they are hardly worthy of mention. However, I would have liked to see one chapter of this book devoted to a general discussion of the many electronic devices used in modern nuclear spectroscopy.

The book should be of great interest and value to all nuclear physicists. Those, in particular, who are working in the field of nuclear spectroscopy must have this excellent work at hand.

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Quantum Theory of Solids. Intern. Ser. of Monogr. on Physics. R. E. Peierls. Oxford Univ. Press, New York–London, 1955. vii + 229 pp. Illus. $4.80.

As the title implies, the problems dealt with in this book are those that require the use of quantum theory. Consequently, there is no discussion of various lattice imperfections. The book is short and thus it does not pretend to be complete. It is good in that it gives a concise, clear picture of the theoretical methods used to treat some, but not all, problems in the field. The author often treats a simple case and then gives a short derivation of the general theorems. Very few experimental data are given; and in many instances once the general relationships are obtained, no numerical estimates of orders of magnitude are stated. The author is, however, careful to point out the experimental physical facts that allow a solution to be obtained by the particular method or approximation employed.

In the first two chapters the normal vibrations of a solid are treated. The discussion is unusual, because it includes the influence of anharmonic terms on the specific heat, the thermal expansion, and the thermal conductivity. The discusison of the thermal conductivity is excellent, although it is evident that the subject is complicated. The next chapter deals with the scattering of electromagnetic radiation by crystals. The discussion is limited to the case in which the initial and final electronic states of the crystal are the same. The influence of lattice vibration

on the widths of x-ray reflections is considered.

The next two chapters consider briefly the motion of electrons in a perfect lattice and the cohesive forces in metals. Following this there is an excellent discussion of electric and thermal conductivity in metals. The treatment is particularly good in its careful examination of the validity of the various assumptions used. After this the author describes present theories for para, dia, ferro, and antiferromagnetism. Then a chapter is included on the absorption and emission of electromagnetic radiation. There follows a brief discussion of semiconductors, rectifying contacts, and luminescence. There is finally a chapter on superconductivity, in which first the experimental facts are presented and then the Bardeen Frohlich theory is discussed with emphasis on the things that remain to be done.

To summarize, this is an excellent book for those who wish to study certain theoretical methods that have been used in the quantum theory of solids. In the particular fields in which some detail is given the treatment is very rewarding.

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Fundamental Formulas of Physics. Donald H. Menzel, Ed. Prentice-Hall, New York, 1955. xxxv + 765 pp. Illus. $13.50. $10.65 to schools.

This book attempts to provide comprehensive coverage, at the research level, of the fundamental formulas of mathematical physics, including classical and modern physics; mathematics and statistics; and various cross-fields such as physical chemistry, astrophysics, and biophysics. The formulas from this broad range are arranged into 31 chapters written by almost as many different authors. There are a 106-page chapter on basic mathematical formulas, a chapter each on statistics and nomograms, a chapter listing recent values of commonly used physical constants, 12 chapters on various aspects of classical physics, ten chapters on topics from atomic and nuclear physics, and five chapters on cross-fields. This style of organization makes it relatively easy to locate the formulas that apply to a particular topic.

Each author was given a free hand in preparing his own chapter or chapters. As a result, there is a wide variety in the styles of the various chapters. Some authors give sketchy coverage and do little more than list formulas, while others write compressed textbooks. In order to get such a large amount of material into a single volume, formulas are given without derivation. There is quite a degree of overlap between certain chapters. The notation varies to some extent from chapter to chapter. Thus the user of the book will usually have to examine the entire chapter in which a formula appears in order to be sure of notation and limitations on applicability. The differences among authors have led to the slighting of some topics relative to others. For example, 31 pages are devoted to special relativity and only 33 pages to classical mechanics and 13 pages to heat and thermodynamics; 44 pages are given to geometrical optics, but only 20 pages to quantum mechanics and 19 pages to nuclear theory. From the standpoint of organization and balance among topics, this book is inferior to its predecessor in the field of formulation, E. Madelung's *Die Mathematischen Hilfsmittel des Physikers.*

Considerable care has been given to the printing of the book; relatively fewer errors show up in equations than in text material. Unfortunately, very few illustrations were used. Only 24 figures appear, 14 of which come in the adequately illustrated chapter on electromagnetic theory. In many instances, simple diagrams would have clarified the meaning of symbols occurring in formulas. Most chapters contain a valuable list of references from which the reader can obtain more detailed information on the topics covered.

The general style of the book is quite sophisticated. The nonspecialist will encounter considerable difficulty in applying the material contained in most chapters. Although the book is broad in coverage, certain topics are omitted or treated very briefly; among these are mechanics of rotation, rigid body mechanics, the tensor character of the mechanical and electric properties of anisotropic bodies, theory of elasticity, crystal structure, and x-rays.

Despite these shortcomings, the editor and authors are to be congratulated upon the preparation of such an extensive compendium of the relationships used in current-day mathematical physics. There is enough material included to make this a valuable reference book for every physicist, theoretical and experimental alike.

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New Books

Science in Progress, Ser. 9. George A. Baitsell, Ed. Yale Univ. Press, New Haven, Conn., 1955. 343 pp. $6.50.

International Review of Cytology. G. H. Bourne and J. F. Danielli, Eds. Academic Press, New York, 1955. 419 pp. $9.

Introduction to Electronic Analogue Computers. C. A. A. Wass. McGraw-Hill, New York; Pergamon, London, 1955. 237 pp. $6.50.

Protein Malnutrition. Proceedings of a conference in Jamaica (1953) sponsored jointly by the Food and Agriculture Organization of the United Nations (FAO), World Health Organization (WHO), and Josiah Macy, Jr. Foundation, New York. J. C. Waterlow, Ed. University Press, Cambridge, England, 1955. 277 pp.

Dried BCG Vaccine. Yoji Obayashi. World Health Organization, Geneva, 1955. 220 pp. $5.

Diesel Engine Principles and Practice. C. C. Pounder, Ed. Philosophical Library, New York, 1955. 848 pp. $17.50.

Infant Nutrition in the Subtropics and Tropics. D. B. Jelliffe. World Health Organization, Geneva, 1955. 237 pp. $5.

A Million Years of Human Progress. Ira D. Cardiff. Pageant Press, New York, rev. ed., 1955. 146 pp. $2.50.

An Introduction to the Principles of Chemistry. L. H. Cragg and R. P. Graham. Rinehart, New York, rev. ed., 1955. 740 pp. $6.50.

A Source-Book of Biological Names and Terms. Edmund C. Jaeger. Thomas, Springfield, Ill., ed. 3, 1955. 317 pp. $5.75.

History of the Cold War. Kenneth Ingram. Philosophical Library, New York, 1955. 239 pp. $5.

Income of the American People. Herman P. Miller. Wiley, New York; Chapman & Hall, London, 1955. 206 pp. $5.50.

The Prince of Botanists, Carl Linnaeus. Norah Gourlie. Witherby, London, 1953. 292 pp. 30s.

The Foreseeable Future. George Thomson. Cambridge Univ. Press, London, 1955. 166 pp. $2.50.

The Bequest of the Greeks. Tobias Dantzig. Scribner's, New York, 1955. 191 pp. $3.95.

Understanding Surgery. Robert E. Rothenberg, Ed. Pocket Books, New York, 1955. 620 pp. $0.50.

Microscopy of Ceramics and Cements. Including glasses, slags, and foundry sands. Herbert Insley and Van Derck Frechette. Academic Press, New York, 1955. 286 pp. $7.50.

Constructional Steelwork. Oscar Faber. Philosophical Library, New York, 1955. 367 pp. $12.

Legal Medicine, Pathology and Toxicology. Thomas A. Gonzales *et al.* Appleton-Century-Crofts, New York, ed. 2, 1954. 1349 pp.

The History of the Telescope. Henry C. King. Sky, Cambridge, Mass.; Griffin, London, 1955. 456 pp. $12.50.

The Natural History of North American Amphibians and Reptiles. James A. Oliver. Van Nostrand, New York, 1955. 359 pp. $6.95.

Prospecting for Atomic Minerals. How to look for and identify atomic ores, stake and protect a claim, evaluate and sell your minerals. Alvin W. Knoerr and George P. Lutjen. McGraw-Hill, New York, 1955. 211 pp. $3.95.

Atomic Energy Research at Harwell. K. E. B. Jay. Philosophical Library, New York, 1955. 144 pp. $4.75.

The Golden Book of Astronomy. A child's introduction to the wonders of space. Rose Wyler and John Polgreen. Simon and Schuster, New York, 1955. $3.95.

Scientific Meetings

American Psychological Association

The 63rd annual convention of the American Psychological Association was held 1–7 Sept. in San Francisco, Calif. Some 4000 psychologists and representatives from allied scientific and professional groups participated in the activities, which included research reports, symposia, invited addresses, film showings, exhibits of new laboratory equipment, and business meetings.

The program of approximately 300 scheduled sessions was organized by committees from each of the 17 divisions of the association. The largest portion (about 15 percent) dealt with topics of primary concern to clinical psychology, such as the role of the psychologist in mental health programs and psychological factors in various disease entities. Papers and discussions relating to psychometrics, to psychology as applied in business and industry, to experimental and social psychology, and to problems of teaching psychology accounted in about equal shares for another 50 percent of the program. The remainder was devoted in smaller portions to a variety of subjects that covered general psychology, counseling and guidance, educational psychology, military psychology, psychology in the public service, esthetics, and the psychology of maturity and old age. In general it can be said that the program reflected the increasing heterogeneity of American psychology, and nonpsychologists could, by scanning the program, obtain a good impression of the burgeoning nature of the field at this point in its course of development.

In a featured symposium aimed at reviewing recent progress and predicting "probable break-throughs" in the scientific aspects of psychology, Harry F. Harlow (University of Wisconsin) felt that the future in physiological and comparative psychology would probably see major developments in research on functions of cortical and subcortical areas as they relate to behavior, in the "psychochemistry" of brain and bodily functions, and in a revival of research on the effects of early development on later behavior. Arthur W. Melton (Lackland Air Force Base) was of the opinion that experimental psychology is generally coming of age in terms of the conception and execution of systematic basic research and that, with the future use of primates and children as the preferred subjects in research, there should be progress in relating developmental psychology and learning theory. Leon Festinger (Stanford University), speaking for social psychology, expressed concern over the uncritical adoption by social psychologists of game theory and communication models in their search for a theory of social behavior. Festinger hoped that future social psychological research would involve inquiries into problems that are both social and psychological in nature, rather than merely convenient for study. Donald G. Marquis (University of Michigan) rounded out the discussion by pointing up the importance of mental health problems and the possibilities that exist for psychology to make some contribution to their solution. It was Marquis' hope that the near future would see a furtherance of our understanding of mental illness through the technique of interdisciplinary research.

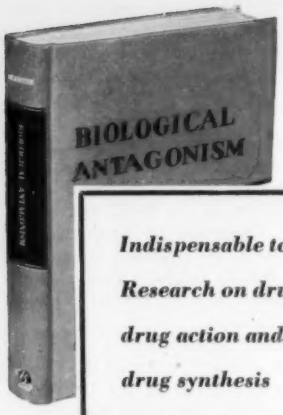
The continued interest of psychologists in research on the intellectually gifted was reflected in a symposium on "The gifted child." Lewis M. Terman (emeritus, Stanford University) reinforced, with further data from his 34-year follow-up study of "genius," evidence that children of high intelligence levels do not, in keeping with popular notions, develop into adults with low physical vitality and meager incomes. As adults, Terman's subjects were reported as standing far above average in physical and mental health, in occupational status, in intellectual achievements, and in income level. In other papers in this symposium, Harrison Gough (University of California, Berkeley) and T. E. Newland (University of Illinois) discussed factors relating to achievement among the intellectually gifted and the problem of meeting the needs of gifted children.

During the past few years psychologists have been very interested in "problem solving" and "reasoning ability"; a variety of research on these topics was in evidence. A series of papers, sponsored jointly with the Psychometric Society, reported work on factor analyses of reasoning ability and creativity (J. P. Guilford, P. R. Christensen, and N. W. Kettner; University of Southern California) and on the identification of factors that function in reasoning-type situations (J. Caffrey and T. W. Smith; Los Angeles County Schools). Examples of experimental papers included a report on the development of suitable criteria for use in research on problem-solving behavior (G. L. Bryan, N. A. Bond, and H. R. LaPorte; University of Southern California) and a new technique for studying problem-solving behavior in nonlaboratory settings (H. J. A. Rimoldi, University of Chicago).

Of general interest was a review by Ralph W. Tyler, director of the Center for Advanced Study in the Behavioral Sciences, of the first year's operation of the center. Thirty-five leading social scientists, including psychologists, political scientists, anthropologists, economists, sociologists, and mathematicians have just concluded a year together at the center (located near Stanford University), discussing mutual problems, reporting research results, and generally exchanging ideas on their respective approaches to social science problems. In Tyler's view, the net effect of the year of study and association will show up during the next few years, and the future writings and research of the group will be studied to determine what they learned from the experience and how they put it to use in their later scientific careers.

A new feature of this year's convention was a day midway in the week of meetings designated as "APA Day." It was a planned attempt to bring together, through a series of sessions having a high degree of common interest, the largest possible segment of the association's heterogeneous membership. The program of the day included three morning symposia: the break-through meeting discussed in a previous paragraph and two others on "Emotional factors in learning" and "Psychologists in the public service." The afternoon program was highlighted by an invited address by J. Robert Oppenheimer, who discussed the role of analogy in the development of science. A box supper followed late afternoon reports to the group by the association's secretary, treasurer, and executive secretary. The evening's events included an address on "Consistency of the adult personality over twenty years" by E. Lowell Kelly (University of Michigan), the retiring president, the induction of Theodore M. Newcomb (University of Michigan) as president for the current year, and a reception for APA members.

Among the announcements of general interest was that of the election of Lee J. Cronbach (University of Illinois) as president-elect of the APA; another was that of the launching, in January 1956, of a new journal to be known as *Con-*



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temporary Psychology—a Journal of Reviews (edited by E. G. Boring of Harvard University). It was also announced that, in the interest of furthering psychology as science, the APA will sponsor annually three APA Distinguished Science Awards of $1000 each for outstanding theoretical and empirical contributions within the field.

JOHN T. WILSON
National Science Foundation, Washington, D.C.

Alaskan Science Conference

The final registration figure for the sixth Alaskan Science Conference, held 1–4 June at the University of Alaska, was 245 and included scientists from continental United States, Alaska, and Canada. The Alaskan Division of the American Association for the Advancement of Science sponsored the conference. President of the organization at the time was Neil W. Hosley (University of Alaska). The Arctic Branch of the AAAS, under the direction of its president, Earl H. Beistline (School of Mines, University of Alaska), was host.

The Cook Inlet Branch, headed by Raymond J. Hock, and the Southeastern Alaska Branch participated in the conference. The president of the latter organization at the time was Amos J. Alter of Juneau. George W. Beadle (president, AAAS; California Institute of Technology) also attended.

Hosley almost set the theme for the conference in his welcoming address when he spoke on "Alaska's natural resources and her future." The papers presented showed that a preponderance of the research dealt with arctic and subarctic subjects.

Six fields were represented. Arthur W. Greeley (U.S. Forest Service, Juneau) headed the agriculture and forestry section. William O. Pruitt, Jr. (Arctic Aeromedical Laboratory, Ladd Air Force Base), headed the biological sciences section. A. F. Ghiglione (Alaska commissioner of roads) was in charge of the engineering section. Earl Maxwell (Elmendorf Air Force Base) was chairman of the medicine and public health program. Margaret Lantis (Arctic Health Research Laboratory, Anchorage) was chairman of the social sciences section. Charles T. Genaux (University of Alaska) headed the physical science section.

Those who attended the conference viewed many displays set up around the campus. One of the larger exhibits showed Pleistocene fossils collected by Otto William Geist (University of Alaska). Included in the display were hair and hide of mammoths. C. T. Elvey, director of the Geophysical Institute, opened its doors to visitors and explained the various equipment used for important arctic and subarctic research.

One of the lectures that attracted many nonscientists, as well as scientists, was delivered by Sydney Chapman who spoke on the International Geophysical Year (IGY) 1957–58. He is chairman of IGY and is visiting professor at the University of Alaska. Other papers of wide interest included those by H. Wexler, Albert Schatz, Walter A. Wood, and A. W. F. Banfield.

One of the social highlights of the conference was a public tea at the home of the university's president, Ernest N. Patty. He also welcomed the scientists immediately after registration.

The hundreds of persons who attended the barbecue at the Tanana Valley Fairgrounds were served bison, caribou, and moose. The speaker was Hubert Wilkins.

CHARLES J. KEIM
University of Alaska, College

Meeting Notes

■ The 1955 Thanksgiving meeting of the American Physical Society will be held in Chicago, Ill., 25–26 Nov. The host institution will be the University of Chicago. The headquarters of the meeting will be in room 480 of the Research Institutes Building, 5630 Ellis Ave. The scientific sessions will be distributed in various buildings on the campus.

Invited papers will be given by L. W. Alvarez, S. Chandrasekhar, G. Dresselhaus, E. W. Friesen, G. Goldhaber, F. Low, D. E. Nagle, R. G. Newton, D. C. Peaslee, F. Rohrlich, C. C. J. Roothaan, M. Ross, J. A. Simpson, R. M. Steffen, and L. C. Teng. Other than the three from the University of California, Berkeley, they are drawn from Illinois and contiguous states. Those of Chandrasekhar and Simpson will embody the observations and conclusions of the authors from the international Congress on Cosmic Rays recently held in Mexico; those of Alvarez and Nagle will pertain to observations made with the bubble chamber. Approximately 183 contributed papers are distributed among 18 sessions.

■ The American Institute of Chemical Engineers has announced the program for its annual meeting to be held at the Hotel Statler in Detroit, Mich., 27–30 Nov. Walter G. Whitman of Massachusetts Institute of Technology, who was conference secretary-general of the recent Geneva nuclear energy conference, will address the awards banquet on 29 Nov.

The meeting will open with a symposium on nuclear engineering education. One of the major problems in the development of industrial uses for the atom is the selection and training of engineers. R. P. Genereaux of the Du

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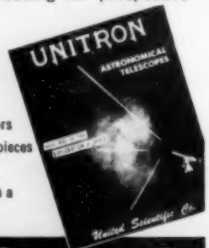

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Other symposia scheduled are as follows: "Evaporators"; "Standardization of centrifugal chemical pumps"; "The technical society—its place and worth in industry"; "Liquid metals in the chemical industry"; "Biochemical engineering"; and "Mechanics of bubbles and drops." In concurrent sessions a wide variety of general technical papers will be presented ranging from kinetic studies to consideration of distillation and extraction problems.

■ A conference on the Microneurophysiology of the Synapse was held at the University of Washington School of Medicine (Seattle), 20–23 Oct. under the joint sponsorship of the university's department of physiology and biophysics, the National Science Foundation, and the State of Washington Fund for Biology and Medicine. The theme of the meeting was the problems of synaptic transmission in the spinal cord and higher centers as studied with intracellular ultramicroelectrode, extracellular electrode, and histological techniques.

The speakers and their topics follow: S. W. Kuffler, "Excitation and inhibition in single nerve cells"; J. C. Eccles, "The ionic movements across the motorneuron membrane and the generation of the inhibitory and excitatory postsynaptic potentials"; Karl Frank, "Analysis of potentials recorded from elements in the spinal cord with micropipettes"; D. P. C. Lloyd, "Steady state of response of motorneurons to afferent volleys in repetitive series"; M. G. F. Fuortes, "Rhythmical reflex firing of motorneurons"; and V. E. Amassian, USAF, "Transmission across sensory synapses."

■ The sixth Thomas Alva Edison Foundation Institute will take place in West Orange, N.J., on 21–22 Nov. It is designed to acquaint its members and the general public with the latest information on the scientific and engineering manpower shortage. The institute members are drawn from education, business and government. The conference theme is "The growing shortage of scientists and engineers."

■ At the invitation of the American Anthropological Association and the University Museum of the University of Pennsylvania, the fifth International Congress of Anthropological and Ethnological Sciences will be held in Philadelphia, Pa., 1–9 Sept. 1956. Abstracts should be submitted *by 1 Mar. 1956*. No papers longer than 20 minutes will be accepted for publication; publication cannot be guaranteed.

Rooms in university buildings will be available to members at $2.50 per night. The registration fee is $10; relatives of members may become associate members, the fee being $3.

Inquiries should be addressed to the Secretary, American Organizing Committee, International Congress of Anthropology, National Academy of Sciences–National Research Council, 2101 Constitution Ave., Washington 25, D.C.

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■ AAAS, Alaska Division: pres., Troy Pewe; v. pres., Charles W. Wilson; sec., Howard Baltzo; treas., Arthur Buswell. Representative to the AAAS Council is Earl H. Beistline.

■ American Academy for Cerebral Palsy: pres., Margaret Jones, University of California Medical Center, Los Angeles; pres.-elect, Nicholson J. Eastman, Johns Hopkins Hospital; sec.-treas., Robert A. Knight, 869 Madison Ave., Memphis 3, Tenn.

Forthcoming Events

December

14. **Operations Research Symposium, Philadelphia, Pa. (R. V. D. Campbell, Operations Research Symposium Registration, Burroughs Research Center, Paoli, Pa.)**

15–17. **Acoustical Soc. of America, Providence, R.I. (W. Waterfall, ASA, 57 E. 55 St., New York 22.)**

15–17. **International Union of Scientific Radio, U.S. national, Gainesville, Fla. (J. P. Hagen, Code 7100, URSI, Naval Research Lab., Washington 25.)**

16–21. **Interamerican Cong. of Psychology, 3rd, Austin, Tex. (W. Holtzman, Univ. of Texas, Austin.)**

26–29. **Biometric Soc., Eastern N. Amer-**

ican Region. New York, N.Y. (A. M. Dutton, Box 287, Station 3, Rochester 20, N.Y.)

26–31. American Assoc. for the Advancement of Science, Atlanta, Ga. (R. L. Taylor, AAAS, 1025 Connecticut Ave., NW, Washington 6.)

The following 32 meetings will be held in conjunction with the AAAS annual meeting.

26–27. American Assoc. of Clinical Chemists, Atlanta, Ga. (A. E. Sobel, Dept. of Biochemistry, Jewish Hospital of Brooklyn, 555 Prospect Pl., Brooklyn 16, N.Y.)

26–30. American Nature Study Soc., Atlanta, Ga. (M. Trussell, School of Education, Florida State Univ., Tallahassee.)

26–30. National Assoc. of Biology Teachers, Atlanta, Ga. (J. P. Harrold, 110 E. Hines St., Midland, Mich.)

27. National Assoc. of Science Writers, Atlanta, Ga. (O. Fanning, Midwest Research Inst., Kansas City, Mo.)

27. National Speleological Soc., Atlanta, Ga. (Bro. G. Nicholas, F.S.C., 114 Hanover St., Cumberland, Md.)

27. Soc. for Research in Child Development, Atlanta, Ga. (W. C. Rhodes, Georgia Dept. of Public Health, Atlanta.)

27–28. American Psychiatric Assoc., Atlanta, Ga. (H. E. Himwich, Research Div., Galesburg State Research Hospital, Galesburg, Ill.)

27–28. Soc. for the Advancement of General Systems Theory, Atlanta, Ga. (L. von Bertalanffy, Psychosomatic Research Inst., Mt. Sinai Hospital, Los Angeles, Calif.)

27–29. American Geophysical Union, Atlanta, Ga. (W. Smith, 1530 P St., NW, Washington 5.)

27–29. American Meteorological Soc., Atlanta, Ga. (K. Spengler, 3 Joy St., Boston, Mass.)

27–29. Assoc. of Southeastern Biologists, Atlanta, Ga. (M. E. Gaulden, Biology Div., Oak Ridge National Lab., Oak Ridge, Tenn.)

27–29. International Geophysical Year, Atlanta, Ga. (H. Odishaw, National Research Council, Washington 25.)

27–29. Oak Ridge Inst. of Nuclear Studies, Atlanta, Ga. (C. L. Comar, ORINS, Oak Ridge, Tenn.)

27, 29. Soc. of the Sigma Xi, Atlanta, Ga. (T. T. Holme, 56 Hillhouse Ave., New Haven, Conn.)

27–30. American Phytopathological Soc., Atlanta, Ga. (G. S. Pound, Dept. of Plant Pathology, Univ. of Wisconsin, Madison.)

27–30. American Soc. of Parasitologists, Atlanta, Ga. (A. C. Walton, Dept. of Biology, Knox College, Galesburg, Ill.)

27–30. Botanical Soc. of America, Southeastern Section, Atlanta, Ga. (R. E. Shanks, University of Tennessee, Knoxville.)

27–30. Ecological Soc. of America, Atlanta, Ga. (E. P. Odum, Univ. of Georgia, Athens.)

27–30. National Science Teachers Assoc., Atlanta, Ga. (R. H. Carleton, NSTA, 1201 16 St., NW, Washington 6.)

27–30. Soc. of Systematic Zoology, Atlanta, Ga. (D. C. Scott, Dept. of Zoology, Univ. of Georgia, Athens.)

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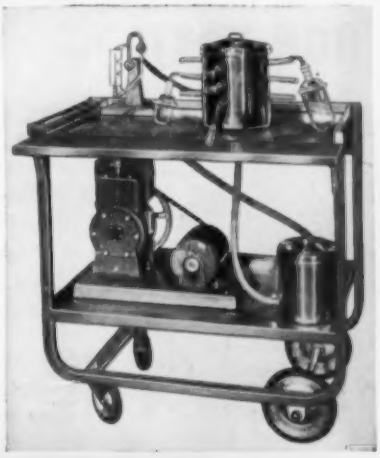

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28. National Assoc. for Research in Science Teaching, Atlanta, Ga. (G. G. Mallinson, Western Michigan College of Education, Kalamazoo.)

28. Sigma Pi Sigma, Atlanta, Ga. (D. R. McMillan, Emory Univ., Emory University, Ga.)

28. Soc. of General Physiologists, Atlanta, Ga. (A. Shanes, National Institutes of Health, Bethesda 14, Md.)

28–29. American Soc. of Naturalists, Atlanta, Ga. (W. P. Spencer, Dept. of Genetics, Univ. of Texas, Austin 12.)

28–29. Conference on Scientific Editorial Problems, Atlanta, Ga. (R. W. Russell, 3518 University Ave., Los Angeles 7, Calif.)

28–29. Herpetologists League, Atlanta, Ga. (J. A. Fowler, Acad. of Natural Sciences, 19th and Parkway, Philadelphia 3, Pa.)

29. American Assoc. of Hospital Consultants, Atlanta, Ga. (J. Masur, Asst. Surgeon-General, USPHS, Washington 25.)

29. National Acad. of Economics and Political Science, Atlanta, Ga. (D. P. Ray, Hall of Government, George Washington Univ., Washington, D.C.)

29. National Geographic Soc., Atlanta, Ga. (W. R. Gray, NGS, 16 and M Sts., NW, Washington 6.)

29. Scientific Research Soc. of America, Atlanta, Ga. (D. B. Prentice, 54 Hillhouse Ave., New Haven, Conn.)

30. American Soc. of Plant Physiologists, Southern Section, Atlanta, Ga. (A. W. Naylor, Duke Univ., Durham, N.C.)

30. United Chapters of Phi Beta Kappa, Atlanta, Ga. (C. Billman, 1811 Q St., NW, Washington, D.C.)

27–29. American Mathematical Soc., 62nd annual, Houston, Tex. (J. H. Curtiss, AMS, 80 Waterman St., Providence 6, R.I.)

27–29. Archaeological Inst. of America, Chicago, Ill. (C. Boulter, 608, Univ. of Cincinnati Library, Cincinnati 21, Ohio.)

27–29. Assoc. for Symbolic Logic, Rochester, N.Y. (J. Barlaz, Rutgers Univ., New Brunswick, N.J.)

27–29. Linguistic Soc. of America, Chicago, Ill. (A. A. Hill, 1719 Massachusetts Ave., NW, Washington 6.)

27–29. Western Soc. of Naturalists, Davis, Calif. (D. Davenport, Univ. of California, Santa Barbara.)

27–30. American Statistical Assoc., New York, N.Y. (E. M. Bisgyer, 1757 K St., NW, Washington 6.)

27–30. Inst. of Mathematical Statistics, New York, N.Y. (K. J. Arnold, Dept. of Mathematics, Michigan State Univ., East Lansing.)

27–1. Phi Delta Kappa, 50th anniversary, Bloomington, Ind. (J. C. Whinnery, 324 N. Greenwood Ave., Montebello, Calif.)

28–29. Northwest Scientific Assoc., Spokane, Wash. (F. J. Schadegg, Eastern Washington College of Education, Cheney.)

28–30. American Economic Assoc., New York, N.Y. (J. W. Bell, Northwestern Univ., Evanston, Ill.)

28–30. American Historical Assoc., Washington, D.C. (B. C. Shafer, Study Room 274, Library of Congress Annex, Washington 25.)

28–30. American Philological Assoc., Chicago, Ill. (J. P. MacKendrick, Bascom Hall, University of Wisconsin, Madison 6.)

28–30. Low Temperature Physics and Chemistry, Baton Rouge, La. (J. G. Daunt, Dept. of Physics, Ohio State Univ., Columbus 10.)

28–30. American Philosophical Assoc., Eastern Div., Boston, Mass. (W. H. Hay, Dept. of Philosophy, Univ. of Wisconsin, Madison.)

28–30. American Physical Soc., winter meeting, Los Angeles, Calif. (K. K. Darrow, Columbia University, New York 27.)

28–30. Econometric Soc., New York, N.Y. (R. Ruggles, Box 1264, Yale Station, Yale Univ., New Haven, Conn.)

29. Metric Assoc., Inc., annual, Washington, D.C. (V. G. Shinkle, 1916 Eye St., NW, Washington 6.)

29–30. American Folklore Soc., Washington, D.C. (M. Leach, Bennett Hall, Univ. of Pennsylvania, Philadelphia 4.)

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29–30. History of Science Soc., Washington, D.C. (T. S. Kuhn, 74 Buckingham St., Cambridge 38, Mass.)

30. Mathematical Assoc. of America, 39th annual, Houston, Tex. (H. M. Gehman, University of Buffalo, Buffalo 14, N.Y.)

January

9–10. Operations Research Soc. of America, 8th national, Ottawa, Ont., Canada. (J. Abrams, Dept. of National Defense, Ottawa.)

9–14. Pan American Cong. of Ophthalmology, 5th, Santiago, Chile. (T. D. Allen, 575 Lincoln St., Winnetka, Ill.)

10. American Ethnological Soc., New York, N. Y. (A. G. James, 695 Park Ave., New York 21.)

10–11. Calcium and Phosphorous Metabolism in Man and Animals with Special Reference to Pregnancy and Lactation, New York, N.Y. (R. R. Marshak, Craigue Hill Rd., Springfield, Vt.)

12. American Genetic Assoc., Washington, D.C. (S. L. Emsweller, Plant Industry Sta., Beltsville, Md.)

12–14. Use of Isotopes in Agriculture, East Lansing, Mich. (E. W. Phelan, Argonne National Lab., Box 299, Lemont, Ill.)

16–18. Documentation Conf., Cleveland, Ohio. (J. H. Shera, School of Library Science, Western Reserve Univ., Cleveland 6.)

17–20. American Pomological Soc., Rochester, N.Y. (R. B. Tukey, Horticulture Dept., Purdue Univ., Lafayette, Ind.)

20–27. Pan American Cong. of Gastro-Enterology, 5th, Havana, Cuba. (N. M. Stapler, 1267 J. E. Uriburu, Buenos Aires, Argentina.)

23–26. American Soc. of Heating and Air-Conditioning Engineers, Cincinnati, Ohio. (A. V. Hutchinson, ASHAE, 62 Worth St., New York 13.)

23–27. Inst. of Aeronautical Sciences, New York, N.Y. (S. P. Johnston, IAS, 2 E. 64 St., New York 21.)

26–27. Western Spectroscopy Assoc. 3rd annual, Berkeley, Calif. (J. W. Otvos, Shell Development Co., Emeryville, Calif.)

30–1. International Conf. on Fatigue in Aircraft Structures, New York, N.Y. (A. M. Freudenthal, 716 Engineering, Columbia Univ., New York 27.)

30–3. American Inst. of Electrical Engineers, New York, N.Y. (N. S. Hibshman, AIEE, 33 W. 39 St., New York 18.)

31–3. American Soc. of Sugar Beet Technologists, 9th biennial conf., San Francisco, Calif. (Western Beet Sugar Producers, Inc., 461 Market St., San Francisco 5.)

31–4. American Physical Soc., New York, N.Y. (K. K. Darrow, Columbia Univ., New York 27.)

February

1–2. Armour Research Foundation Midwest Welding Conf., Chicago, Ill. (H. Schwartzbart, Armour Research Foundation, Illinois Inst. of Technology, Chicago.)

2–3. National Symposium on Microwave Techniques, Philadelphia, Pa. (S. M. King, Inst. of Radio Engineers, 1 E. 79 St., New York 21.)

5–8. National Citizens' Planning Conf., Washington, D.C. (Miss H. James, 901 Union Trust Bldg., Washington 5.)

9–10. Soc. of American Military Engineers, annual, Chicago, Ill. (D. A. Sullivan, 72 W. Adams St., Chicago 90.)

19–23. American Inst. of Mining and Metallurgical Engineers, New York, N.Y. (E. O. Kirkendall, AIME, 29 W. 39 St., New York 18.)

19–23. Soc. of Economic Geologists, New York, N.Y. (O. N. Rove, Union Carbide and Carbon Corp., 30 E. 42 St., New York 17.)

20–22. American Educational Research Assoc., annual, Atlantic City, N.J. (F. W. Hubbard, AERA, 1201 16 St., NW, Washington 6.)

23–25. National Soc. of College Teachers of Education, Chicago, Ill. (C. A. Eggertsen, School of Education, Univ. of Michigan, Ann Arbor.)

24–25. American Physical Soc. Houston, Tex. (K. K. Darrow, APS, Columbia Univ., New York 27.)

26–29. American Inst. of Chemical Engineers, Los Angeles, Calif. (F. J. Van Antwerpen, AIChE, 25 W. 45 St., New York 36.)

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March

12–16. National Assoc. of Corrosion Engineers, 12th annual, New York, N.Y. (Secretary, NACE, Southern Standard Bldg., Houston 2, Tex.)

14–17. National Science Teachers Assoc., Washington, D.C. (R. H. Carleton, NSTA, 1201 16 St., NW, Washington 6.)

15–16. Food Physics Symposium, 1st international, San Antonio, Tex. (C. W. Smith, Southwest Research Inst., San Antonio.)

15–17. American Physical Soc., Pittsburgh, Pa. (K. K. Darrow, APS, Columbia Univ., New York 27.)

15–17. Kappa Delta Pi, annual Stillwater, Okla. (E. I. F. Williams, 238 E. Perry St., Tiffin, Ohio.)

16–18. International Assoc. for Dental Research, St. Louis, Mo. (D. Y. Burrill, 129 E. Broadway, Louisville 2, Ky.)

18–24. American Soc. of Photogrammetry, annual, joint meeting with American Cong. on Surveying and Mapping, Washington, D.C. (ACSM–ASP, Box 470, Washington 4.)

19–23. American Soc. of Tool Engineers, Chicago, Ill. (H. C. Miller, Armour Research Foundation, 35 W. 33 St., Chicago 16.)

21–22. National Health Forum, New York, N.Y. (T. G. Klumpp, National Health Council, 1790 Broadway, New York 19.)

21–23. American Power Conf., 18th annual, Chicago, Ill.. (R. A. Budenholzer, Illinois Inst. of Technology, Chicago 16.)

23–24. Eastern Psychological Assoc., Atlantic City, N.J. (G. G. Lane, Univ. of Delaware, Newark.)

24–25. American Psychosomatic Soc., 13th annual, Boston, Mass. (T. Lidz, APS, 551 Madison Ave., New York 22.)

24–31. Perspectives in Marine Biology, La Jolla, Calif. (A. A. Buzzati-Traverso, Scripps Institution of Oceanography, La Jolla.)

25–28. American Assoc. of Dental Schools, annual, St. Louis, Mo. (M. W. McCrea, 42 S. Greene St., Baltimore 1, Md.)

25–29. American College Personnel Assoc., Washington, D.C. (Miss C. M. Northrup, Univ. of Denver, Denver, Colo.)

28–3. Colloquium on Frontiers in Physical Optics, Boston, Mass. (S. S. Ballard, Visibility Lab., Scripps Institution of Oceanography, San Diego 52, Calif.)

29–31. Pennsylvania Acad. of Science, Indiana. (K. Dearolf, Public Museum and Art Gallery, Reading, Pa.)

29–31. Southern Soc. for Philosophy and Psychology, Asheville, N.C. (J. E. Moore, Georgia Inst. of Technology, Atlanta.)

29–31. Symposium on Fundamental Cancer Research, 10th annual, Houston, Tex. (G. Taylor, Univ. of Texas Postgraduate School of Medicine, Houston 25.)

30–31. Alabama Acad. of Science, annual, Montevallo. (H. A. McCullough, Howard College, Birmingham, Ala.)

April

2–5. Assoc. of American Geographers, annual, Montreal, Canada. (B. W. Adkinson, Library of Congress, Washington 25.)

Equipment News

■ AEROSOL SAMPLING INSTRUMENT model 100B Thermopositor, is designed to offer 100-percent collection efficiency, wide particle size range, and simplicity and versatility of operation. (Roy A. Martin Co., Dept. Sci., 809 Wellesley Drive N.W., Atlanta 5, Ga.)

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■ NEW INSTRUMENTS of various types are described in the 24th edition of "What's new for the laboratory," which is available on request. (Scientific Glass Apparatus Co., Inc., Dept. Sci., 100 Lakewood Terrace, Bloomfield, N.J.)

■ NUCLEAR REACTOR SIMULATOR by Leeds and Northrup permits electronic synthesis of reactor operating conditions. An analog computer solves the differential equations that represent the kinetic operation of a nuclear reactor. The remainder of the assembly includes recorders to measure and chart pile period and linear flux, servo amplifier, rod drive mechanisms, log N amplifier, model reactor core, and other equipment. The simulator can synthesize the operation of several types of reactors. Folder ND46-70-700 (2). (Leeds and Northrup Co., Dept. Sci., 444 N. 16 St., Philadelphia 30, Pa.)

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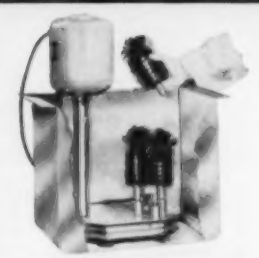

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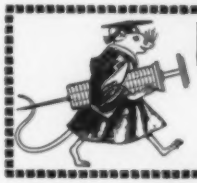

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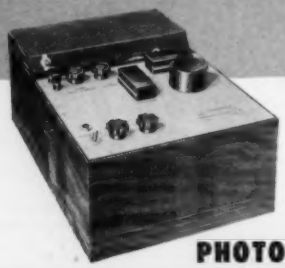

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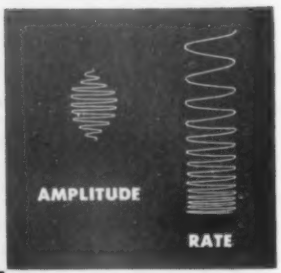

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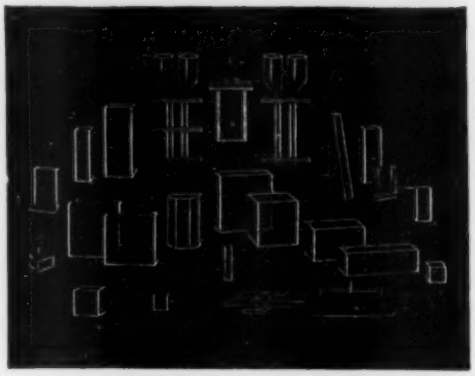

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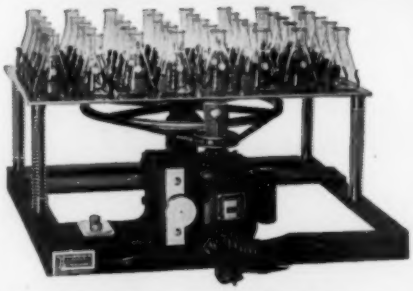

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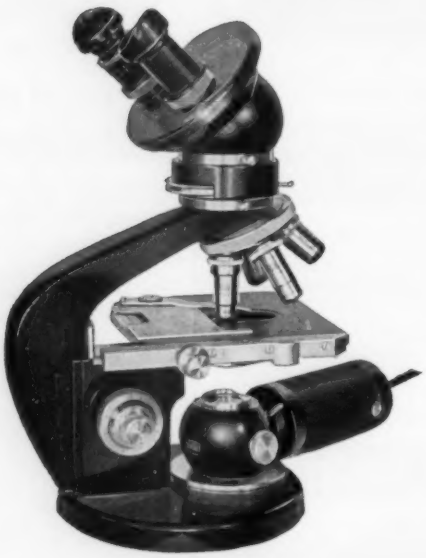

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